FUTURE OF FOOD & BEVERAGE

A shared vision for sustainable agriculture

Agriculture is facing unprecedented challenges. The supply of safe, nutritious and affordable food that is accessible for a growing population must always be the priority.

But for our food systems to be sustainable, we must also consider how we can continue to build systems that are productive and resilient, and which provide a viable livelihood for hundreds of millions of farmers around the globe.

Agriculture uses 70 per cent of the world's fresh water and is a major source of greenhouse gas emissions, and we must continue to develop solutions that address all these challenges.

To do so, Syngenta believes it is time to have a more direct and inclusive conversation to help rebuild the trust between science and society. We need to work in a way that continues to build confidence in the farming and agricultural innovation sectors.

How do we build productive and resilient farms? What role will modern agricultural technologies play? And what production models and policies are needed to support this?

Existing technologies such as targeted pesticides, seed genetics, and promoting climate smart agriculture can help address such questions. And new solutions are emerging all the time, as seen with the power digital technology is bringing to enable even better management of land and crop protection.

What could the future look like if by bringing these technologies and other advances together we could speed up new developments coming to market? What if we could create more diverse ways to produce food? And what if these could give the whole world even better quality food – safely feeding the world while taking care of the planet?

Right now, sustainable agriculture means different things to different people, and it is hard to find a global consensus on how to achieve it.

But there is a loud and growing view that we can only solve the sustainable agriculture challenge if we look at the system as a whole - resist prioritizing one perspective over another and work together to find the right solutions.

As Syngenta looks towards the next iteration of its Good Growth Plan and where our business will focus, we come back to one question: what if we could accelerate progress for us all by starting to develop a common vision? A model that could support a wide range of contexts.

With this goal in mind we have been consulting with a range of stakeholders on a shared vision for sustainable agriculture. Our aim is to bring together different views around a global vision that takes into account different perspectives and farming systems and builds a picture of how we might achieve it - by working together.

Alexandra Brand
Chief Sustainability Officer, Syngenta

www.syngenta.com

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Feeding the hungry and saving planet Earth

Abolishing famine and limiting climate change – arguably the two biggest challenges facing world leaders – cannot be mutually exclusive aims

HEIDI VELLA

The urgent issue of feeding the world's growing population is one of competing proprieties and glaring contradictions. While a third of the food produced globally for human consumption every year is lost or wasted, according to the United Nations Food and Agriculture Organization (FAO), the World Food Programme reports that around 821 million people go hungry daily.

Meanwhile, the FAO says agriculture, including forestry, fisheries and livestock, generates around a fifth of the world's greenhouse gas emissions; a figure that will need to fall if global warming is to be kept at 1.5C by 2030, as leading climate scientists advise.

Yet by 2050 the UN estimates two billion more people will need to be fed. So how can we tackle the momentous task of feeding a population of nine billion, while also saving the planet?

With optimism, ambition and radical solutions, according to Christiana Figueres, former executive secretary of the UN Framework Convention on Climate Change.

Ms Figueres should know. She assumed her role at the UN in 2010, six months after the failed UN Climate Change Conference in Copenhagen. During the next six years, she worked tirelessly to rebuild the negotiating process culminating in the historic 2015 Paris Agreement.

She continues this work as co-founder of Global Optimism, an enterprise focused on social and environmental change, and as convener of Mission 2020, a global effort to ensure carbon neutrality is achieved by 2050.

"Feeding nine billion people is at the nexus of many different global trends: growing populations, the concentration of people in cities, the need for good jobs; not just climate change," says Ms Figueres. "This means there is no one technology or solution."

A priority, however, should be to address wasteful land use. As part of the Mission 2020 project, one of its six milestones is achieving better land use, specifically ending net deforestation by the 2020s, eventually to reduce land use by 95 per cent of 2010 levels up to 2030.

Guillermo Gutierrez/Bloomberg via Getty Images

Christiana Figueres, former executive secretary of the UN Framework Convention on Climate Change

This requires the food industry to be more efficient, both for acreage per production, but also for geographical siting, because climate change is disrupting the global hydrological cycle, says Ms Figueres.

"Ten, forty years ago there were areas around the planet known as the agricultural belts, now those zones are shifting as precipitation moves elsewhere," she explains.

"We need adaptive technologies to be developed, such as seeds and plants that are more resilient to drought, so we can continue to cultivate food in those areas."

Farmers in Cape Town, South Africa, for example, have been forced recently to find new solutions after suffering from a prolonged period of drought that threatened to wipe out food production.

"Preparing for events like that in the hydrological cycle is going to be absolutely critical," says Ms Figueres. "Farmers across the globe need more information about weather patterns and demand, so they can plan better."

Land, however, is not the only way to produce food, she says, referring to vertical farming, the practice of producing food in vertically stacked layers. Though nascent, the technology is evolving with commercial ventures such as Plenty, an ag-tech startup backed by SoftBank and Amazon's Jeff Bezos, and AeroFarms ploughing millions into city-based vertical farms.

"The more concentration of people in cities, the more vertical farming we're going to need, because it's not just about soil and land use, but transportation of food adding to its carbon footprint," says points out.

Ms Figueres proposes what she calls "three provocative ideas". The first is asking fossil fuel companies, already required to reduce their emissions, to finance the reforestation of degraded lands. She concedes that there are problems with this idea, but reiterates that we need to be thinking "not just outside the box, but without it".

Secondly, she says, we should all be vegetarians and restaurants should treat meat eaters like smokers, by making them eat outside, because meat is "bad for the planet and our health". "Very, very provocative, but why not?" she asks.

Some 26 per cent of the planet's ice-free land is used for livestock grazing and around 33 per cent of croplands are used for livestock feed production, according to the FAO.

The idea of reducing livestock use is slowing gaining traction, with several companies starting to offer technologically impressive alternatives, such as Memphis Meats that grows meat in a lab and JUST Inc, which produces a plant-based alternative to eggs.

Lastly, Ms Figueres says global fertiliser companies should take food waste and return it to the soil. "Instead of wasting food, fertiliser companies should be thinking about how it can be gathered and reused," she says.

Ms Figueres has radical ideas, but are they realistic? Can culture and habits be transformed, and technology adopted fast enough, to meet both the competing priorities of ending global hunger and combating climate change. Or is the challenge too great?

"We can't afford not to meet them because generations will suffer, so I don't take it from anybody when they say, 'Oh well, it's impossible'. No, I'm sorry, impossible is an attitude, it's not a fact. So change your attitude because we're going to make it possible," Ms Figueres concludes. ◆

1/3

of the food produced globally for human consumption every year gets lost or wasted

United Nations Food and Agriculture Organization

13BN

hectares of forest area are lost every year due to land conversion for agricultural uses

United Nations Food and Agriculture Organization

821M

people go hungry daily

World Food Programme

PERSONALISATION

DNA testing sets new menu for the future

DNA-specific food, tailored to individual consumers, looks set to open up new revenue streams, at least for niche producers

RICH McEACHRAN

A kit arrives through the letterbox; it contains materials for collecting saliva and blood samples. You swab your cheeks and prick your fingertips, and send your DNA back to the address given. Within four to six weeks you receive a report detailing how your body responds to all types of food. You're then sent weekly recipe suggestions that are tailored to your ideal ratio of fat, carbohydrates and protein.

Welcome to the world of personalisation, an emerging trend in the food industry that is tapping into the health-conscious market. According to the 2016 *Nielsen Global Health and Ingredient Sentiment Survey*, 70 per cent of 30,000 respondents from across 63 countries said they actively make dietary choices to help prevent health conditions, such as obesity, diabetes and high cholesterol.

Campbell Soup Company and Nestlé are the two biggest names to have taken a gamble on DNA-specific food. In 2016, the former invested $32 million (£25 million) in Habit, the leading DNA-cum-nutrition testing service. Meanwhile, the Swiss food and beverage company is reported to be piloting personalised nutrition in Japan; around 90,000 users of the Nestlé Wellness Ambassador programme can submit photos of their food via an app, which then recommends lifestyle changes. The programme can cost $600 (£468) a year if users want a DNA testing kit and to receive in return specific supplements, such as nutrient-boosted green tea, based on their individual data.

Personalisation is nothing new – it's long been possible to add a name and message to a cake, decorative biscuit or packaging – but the increase in the number of people, who want to understand the bacteria in their gut, for example, is creating an opening for the industry.

"Data collected through DNA testing and personalising diets is going to have a significant financial impact for food manufacturers as it opens up whole new marketing and revenue opportunities," says Tarryn Gorre, co-founder of Kafoodle, a food tech startup that combines personalised meal planning with software for monitoring nutritional needs.

"Nutritionally focused food and drink will become more mainstream, but I believe it will be a pull [rather than pushed on consumers]. It will be tailored to those already looking to add a particular nutrient to their diet and even those with allergies," Ms Gorre adds.

Looking at what this actually means for the food industry, delivering personalised products to the masses won't be without its challenges. The Food Standards Agency (FSA) in the UK and the US Food and Drug Administration have strict guidelines about what can be put on labels, and the nutritional claims that can and can't be made.

Ms Gorre says there's also the concern that it could increase food waste.

Data collected through DNA testing and personalising diets is going to have a significant financial impact for food manufacturers as it opens up whole new marketing and revenue opportunities

Products would have to be processed and manufactured in advance, but by the time they reach consumers, there may no longer be the demand for them.

Dr Shaobo Zhou, senior lecturer in nutritional science at the University of Bedfordshire, believes scientific, legal, social and economic barriers mean you're not likely to see the major food manufacturers developing personalised products to be sold by supermarkets, at least not for now.

"Given the unanswered questions around personalising nutrition, it's unlikely you'll see a food company produce individualised products on an industrial scale," says Dr Zhou. "Focusing on more pressing issues, like reducing salt and sugar levels, would be a much more impactful way for the food industry to improve individual and public health."

While personalised products may not be sitting on shop shelves in the near future, what is likely to happen is that food companies will partner with startups and tech companies to improve existing processes and services, in catering and hospitality settings, for example.

"I think personalised eating is an experience that will be integrated into many dining establishments. There will be a rise in a more component way of eating. For instance, salads bars will use food technology to enable consumers to tailor each salad to their exact preference, by adding protein or reducing carbohydrates," argues Ms Gorre, whose own company has developed software to optimise the nutritional care of patients and residents in the health and social care sectors.

At the other end of the spectrum, small brands without the resources to invest in DNA-cum-nutrition testing, will play a role in personalising food delivered to the door. One such brand is Allplants, a startup that delivers plant-based meals prepared by experienced chefs.

Allplant's co-founder Alex Petrides, who founded the startup with his brother Jonathan, believes smaller companies can be better at getting to know consumers on a personal level and understanding their preferences.

"We've been visiting our customers in their homes from day one. It helps us to understand the role we're playing in their lives, what we're doing right, by luck or design, and friction points that we can improve on," says Mr Petrides, former brand director at Propercorn, marketed as a healthy snack.

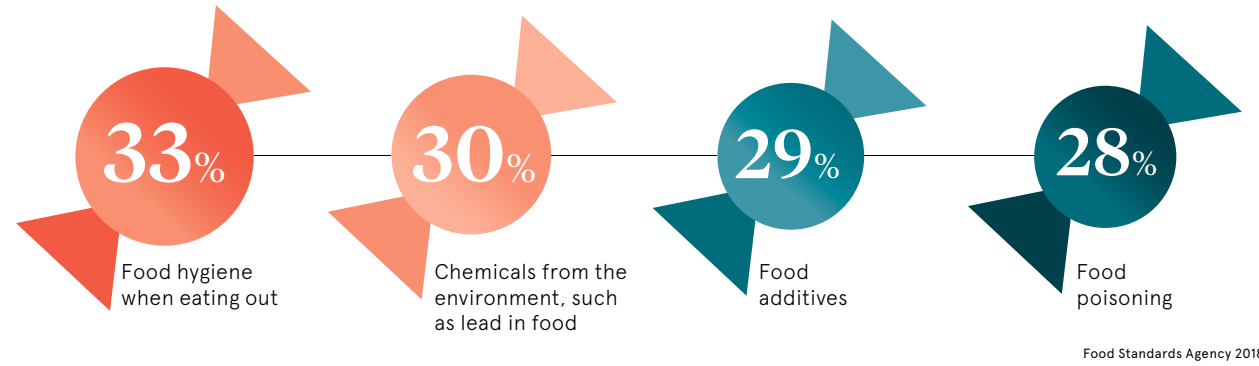
"Sometimes it simply helps us to realise things, like the fact that people are taking our meals to work for lunch. Then we can tailor our offering further, by selling personalised cooler bags, for example. [Engaging with customers] is constant market research, and it's critical to our continual improvement and building the trust behind our brand."

In the FSA's latest *Biannual Public Attitudes Tracker*, 75 per cent of those surveyed said they trust that food is what it says it is and that it's accurately labelled.

As the trend of personalising diets continues to grow, finding ways to build trust will be essential, especially if you'll be handing over your DNA for the ideal amount of protein in your diet. ◆

Top food-safety concerns

Survey of consumer attitudes towards food in England, Wales and Northern Ireland



Food Standards Agency 2018

Benefits of digitalisation give F&B plenty to chew on

Fusion of low-cost sensors, robust communications networks and cloud computing has transformed a variety of sectors, from manufacturing to financial services. Now the food and beverage (F&B) industry is beginning to realise the benefits digitalisation can deliver, says **Darcy Simonis**, group vice president, food and beverage, ABB

The F&B industry has been slow to embrace technology, mainly because factories are typically between 30 and 50 years old, and many still rely on spreadsheets and paper production schedules. Organisations lumbered with legacy systems might have a complex conglomeration of equipment from across the ages, which lacks the connectivity that can provide data or be used as an internet of things (IoT) solution.

Also the F&B industry is traditionally conservative and because of food-safety issues those in charge of plants are naturally not overly keen on sharing data with the outside world. In addition, there are the fundamental problems of not knowing where to start with digital transformation or how much it will cost.

The pressure on F&B makers has never been higher. They must manage many complexities in parallel: uncompromising safety, hygiene, traceability and transparency; continuous, reliable operations in extreme temperatures and corrosive environments; and shorter product cycles with greater variation.

Many leaders of F&B organisations realise that it is becoming critical to adopt automation and other tech-powered solutions, as they will sharpen quality and improve productivity, and help them stay ahead of ever-increasing expectations of customers with competitiveness and agility. Some plants have only rudimentary, isolated pockets of automation, limited to programmable logic controllers (PLCs), and supervisory control and data acquisition (SCADA) systems. Another challenge has been connecting IoT solutions from different vendors and being unable to optimise efficiency as they will not communicate together.

Now, however, technology has caught up with expectation. ABB offers a range of end-to-end solutions, through plant assessments, our ABB Ability™ portfolio and centres of excellence, to help manufacturers benefit most from today's technological opportunities.

We deliver technology that is used in factory machines and process lines to support flexible, cost-effective production. Specifically, we can assist with advanced scheduling, quality control, monitoring, tracking and tracing within the factory, as well as to and from the consumer, plus predictive maintenance, all while optimising energy efficiency.

For instance, the ABB Ability™ platform is a unified, cross-industry digital offering, extending from device to edge, to cloud, with devices, systems, solutions and services. It uses a standardised set of digital building blocks that can communicate with other platforms.

We provide plant assessments, interviewing the factory management team and analysing the current status of digitalisation. We then propose a list of potential solutions. These range from low-hanging fruit to more longer-term solutions that align with the organisation's objectives. ABB implements the solutions and helps with training, which is essential in change management.

Low-hanging-fruit solutions can be installed relatively quickly and generate a quick return on investment, such as smart sensors that convert traditional motors, pumps and mounted bearings into smart, wirelessly connected devices. Another example is our Orange Box product that can be implemented in a day. It collects data from PLC connection points, sensors and other data sources, and thereby helps calculate the factory's overall equipment effectiveness (OEE) and identify where improvements can be made.

We have a group of F&B experts and industry customers who meet to discuss common challenges. We then collaborate with our partners to develop solutions for these challenges.

ABB is also driving innovation in the F&B industry and co-develop customised solutions through our ABB Customer Experience Centres and smart labs, dotted around the world.

More than

130

years of technology

Operations in over

100

countries

Around

147k

team members

More than

300k

robots installed

$1.4bn

investment in R&D every year

Ultimately, all F&B plants will need to undergo digitalisation to some degree to keep pace with change. Early adopters in the industry are reaping the rewards and, after taking advantage of quick wins and establishing a long-term digital strategy, they stand the best chance of success in the future.

For more information please visit www.abb.com/food&beverage

ABB

Five levels of plant digitalisation

01

Clipboards and spreadsheets
No automation. Plants rely on Excel spreadsheets and paper schedules, and have very little operational data to inform decisions.

02

Island life
Some basic digitalisation. Isolated automation with programmable logic controllers (PLC), and supervisory control and data acquisition (SCADA), but implemented on an ad hoc basis with no communication between islands.

03

Digitally curious
Management is talking with suppliers about digital and beginning to experiment with pilot programmes. PLC/SCADA automation is in place, but is now being connected and augmented with digital solutions.

04

Embracing data
The plant has digital solutions in production with formalised plans and strategy to take it to the next level.

05

Digitally actualised
The fully digitalised plant has integrated solutions across the production process and supply chain with links to enterprise systems.

Case study

CUTTING EDGE SERVICES

Cutting Edge Services has been operating for 25 years and is pushing to modernise the UK food and beverage industry. In doing so the Chorley-based supplier of food-processing machinery and knife-sharpening services is a cut above rivals in an industry that has been slow to embrace technology.

Cutting Edge is using ABB's smart sensors for motors and pumps, and its Orange Box, an industrial internet of things solution for brownfield installations, to introduce digitalisation.

Sam Tinsley, managing director of Cutting Edge, says traditional food-processing machinery "lacks the intelligence to provide digital insights into how processes can be made safer and more efficient".

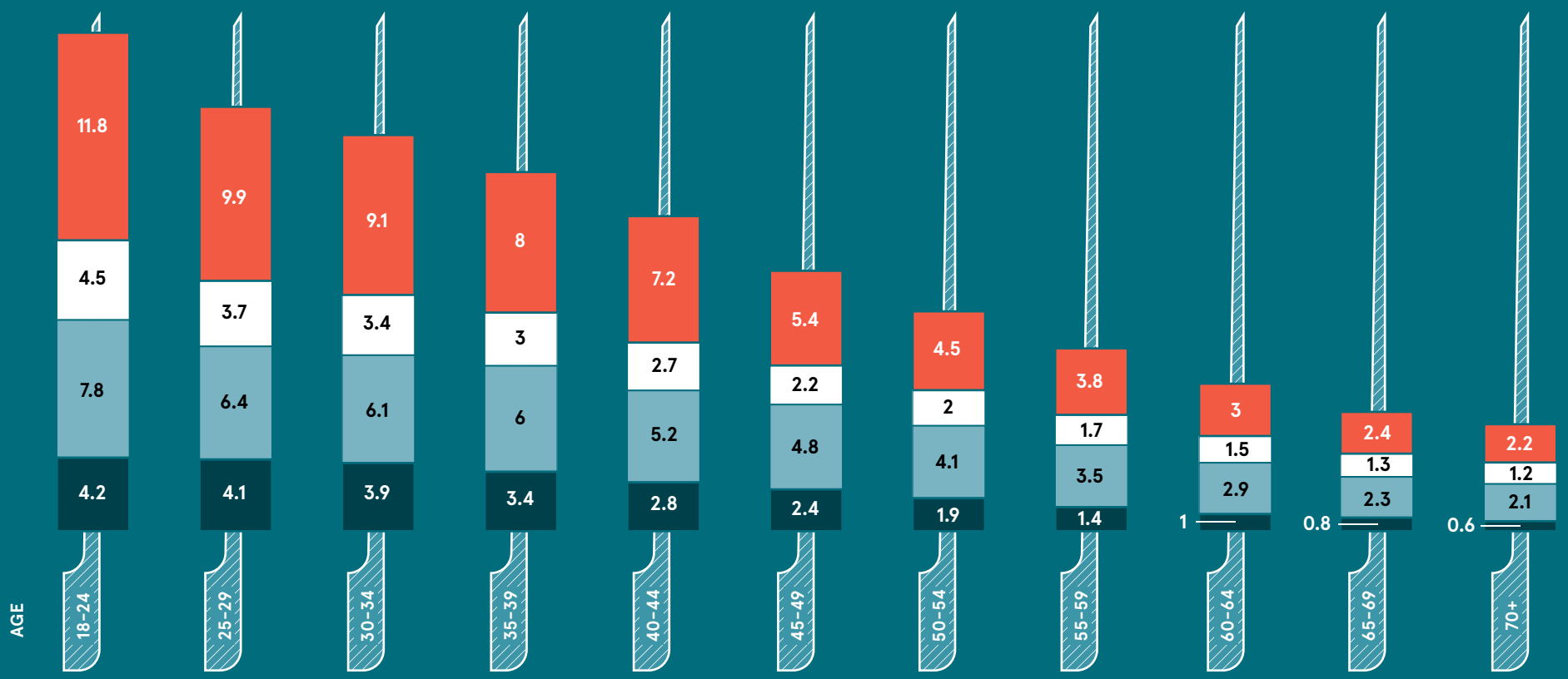
She says: "Because meat processors are under pressure from their retail customers to deliver products around the clock, in the past they've taken a short-term view on return on investment for their legacy equipment, favouring a payback period of 12 months or less. The squeeze from retailers and from the labour market means they now have to look beyond this.

"While manufacturers now understand that adopting digital technologies is crucial in bringing about a sustained benefit to their business, there is a lot of uncertainty, confusion and fear about what steps they need to take. This is why we wanted to collaborate with a trusted technology partner that could help us achieve our customers' vision."

7 WAYS UK DINING IS CHANGING

01 Younger diners eat out more often

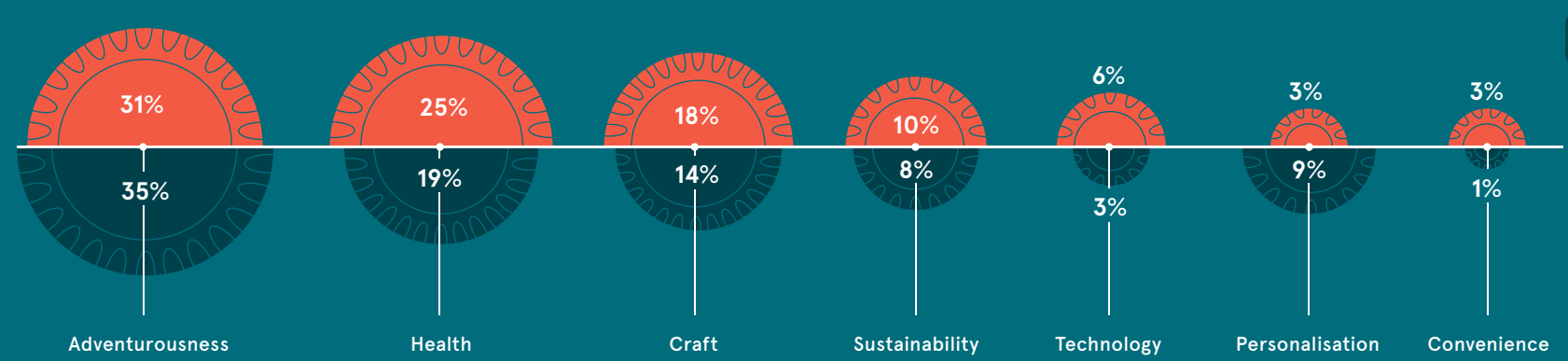
Figures showing the average monthly number of out-of-home meals indicate that younger demographics will shape the future landscape of the restaurant industry



MCA/Deloitte 2017

02 Responsible trends are shaping the market

Things diners look for when they eat out (hot food only)



MCA 2018

At a time of shifting dietary needs and eating habits, along with the explosive growth of delivery platforms, the casual eating sector in the UK is struggling, with many well-known chains closing venues or shutting up shop completely. On the face of it, the eating-out market remains in good health, expanding 1.7 per cent to £87.9 billion in 2017, according to MCA. However, while spend per visit has risen 3 per cent, the frequency of visits has dropped 8 per cent, suggesting a more discerning consumer. This infographic takes a look at some of the trends affecting the industry and the reasons behind such disruption

03 Instagram has transformed the restaurant experience

30% of 18 to 35 year olds would avoid a restaurant if it had a weak Instagram presence

5 days average time spent a year by this age group browsing food images on Instagram

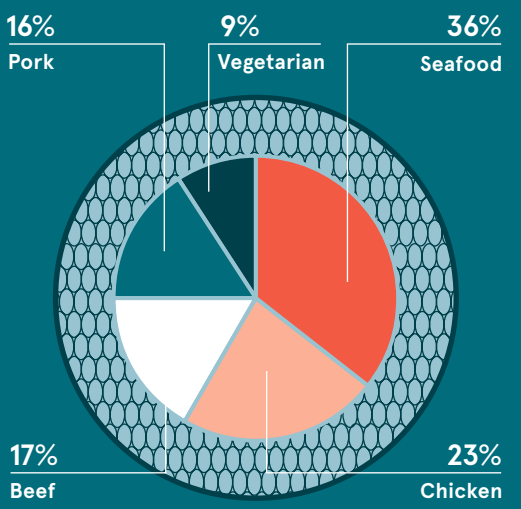
Zizzi 2017

60% of Instagram users following food venues say they have already spent money or are planning to do so there in the future

Only Way Online 2017

04 Dietary requirements are changing

Percentages of restaurant mains by protein group show that under one tenth of meals cater for vegetarians despite increasing demands for less meat



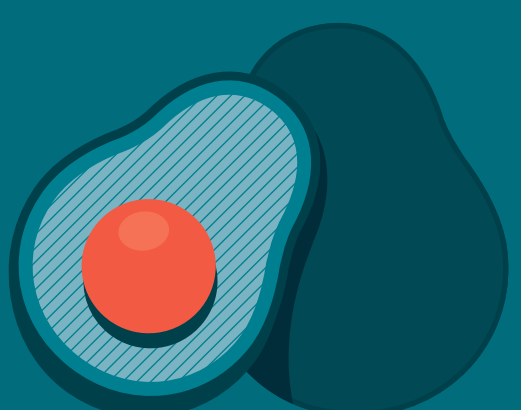
MCA 2018

28% of people in the UK identify as meat reducers, with 78 per cent of these avoiding restaurants due to a lack of non-meat options

More Than Carrots 2018

05 Breakfast is big business

Increased demand for high-quality breakfasts and brunches means branded restaurant chains may be losing out on a lucrative, and growing, slice of the food service market through restricted opening times



79.5m Instagram posts tagged with #breakfast

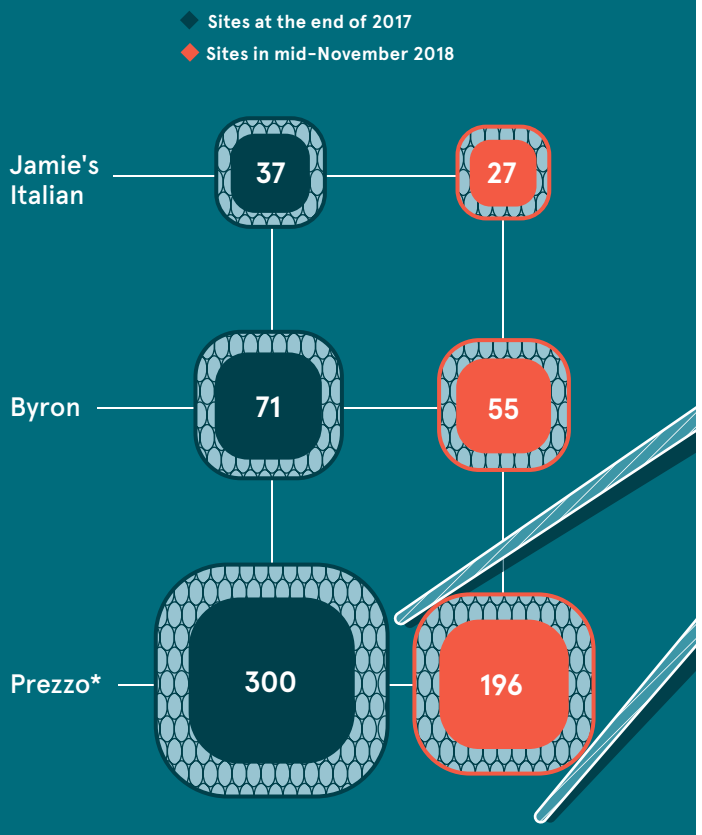
Instagram 2018

508% increase in orders of breakfast takeaway food between 2014 and 2017

CEBR/Just Eat 2017

06 Closures have plagued the branded sector

Number of UK restaurants of the following brands

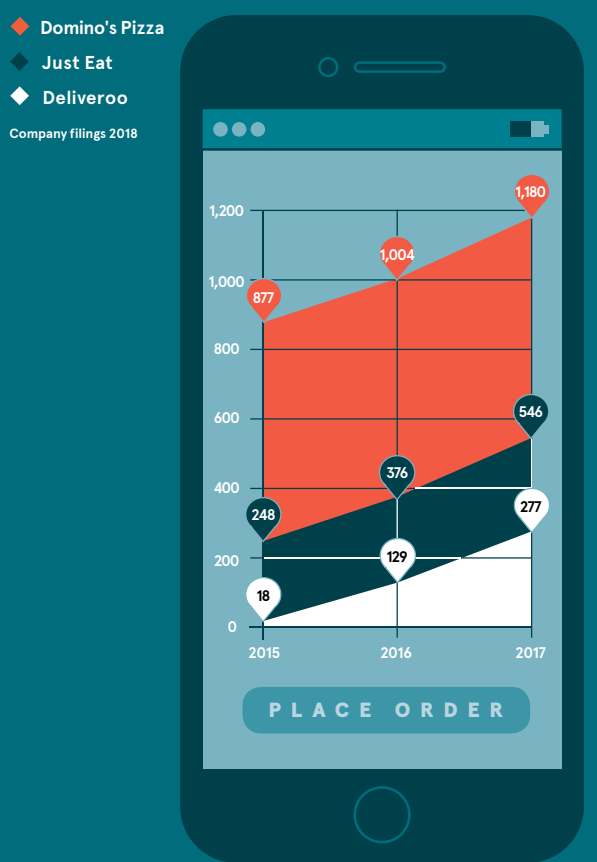


*Includes other branded restaurants under the Prezzo umbrella

Company filings and websites 2018

07 Takeaways continue to deliver

Group revenue of takeaway companies (£m)



Company filings 2018

Commercial feature

Food processing ushers in Industry 4.0

Tight profit margins and increasingly demanding customers are driving the food and beverage industry to embrace the benefits of digitalisation

Solutions aimed at digitalising production are not new, but next-generation automation tools present an array of new possibilities for food processing businesses.

"If you think about automation on a broad scale, many exciting technologies are available for the food and beverage industry to use," says Ulrik Lund Jakobsen, head of food applications at GEA, one of the largest suppliers of food processing technology.

"From growing concerns around food safety and quality to increasing energy costs and environmental considerations, automation plays a key role in addressing these issues."

Introducing elements of automation to manufacturing processes not only unlocks substantial cost-savings, but food safety is also more closely kept in check, by ensuring the production of goods is observed at every step of its journey to the customer.

The future of food and beverage production will see robotics and automated factories take hold in the sector, fundamentally improving security, sustainability and speed.

Ulrik Lund Jakobsen
Head of food applications, GEA

"Food safety and quality verification are key," says Mr Jakobsen. "If the focus is on the health and nutrition of a product, we need to be sure that nothing went wrong in the process. For example, if an item is overcooked, vitamins may be lost; an automated system can instantly flag this and remove the product from the line."

Consumers are the real winners when it comes to modern food processing as they now have access to deeper insights about where their products come from. The use of sensors in the supply chain provides end-to-end traceability for producers and, in the process, enables regulatory requirements to be better met.

As the topic of food fraud becomes increasingly relevant, detailed data around food creation and the supply chain will bolster consumer trust in the authenticity and legitimacy of the foods they purchase.

GEA believes that looking at the entire value and supply chain is not only a question of responsibility, but also gives producers a way to take more control over their businesses. The primary aim of GEA digitalisation projects in the last few years has been to afford producers maximum flexibility along the supply chain, while simultaneously reducing their level of tied-up capital.

For example, GEA uses an IT-based brewery environment capable of connecting production technology with the storage, delivery and order management system. This integrative approach begins with the supermarket behaviour of consumers, which is the starting point for organising the whole supply chain. This data is vital for business processes, including raw material yield, plant availability and efficiency, while supporting preventive maintenance.

"Can we do this without automation? Yes, we could, but then we would miss out on the scale and cost benefits," says Mr Jakobsen. Ultimately, automation is about harmonising interfaces and standardising the exchange of data between automation and engineering systems, which leads to shorter time to market, greater flexibility, improved product quality and efficiency.

This shift in production will require employees to take part in advanced training so they can adapt quickly and get accustomed to working with cutting-edge machinery.

Digital twin technology, where a digital replica of a physical asset is created, enables companies to train operators in a simulated factory or on a piece of new equipment before they begin working in the real plant or new system. The advantages are many, including risk minimisation, early detection and elimination of errors, shorter commissioning times, as well as more time to train operating personnel safely on a test platform before production begins.

At GEA, exciting new automation-based solutions are keeping costs down and enhancing food quality.

"The cost of leveraging preventative or remote maintenance based on feedback from an automated system is far less than compared to a plant that's standing idle because of a missing spare part; these are two very different situations. The fact is that in an automated plant it's much easier to do proactive management and predict the lifespan of machinery," says Mr Jakobsen.

"For us it's not just selling a plant, it's about helping our customers be successful. The whole service concept is what matters."

For more information please visit gea.com

GEA engineering for a better world

GENE EDITING

Scientists aim to increase food supply

Gene-edited food has the potential to feed the world's hungry, but may be blocked in the European Union

MARK WILDING

For nearly 15 years, Professor Nigel Halford has been trying to improve wheat. When wheat is cooked, it forms acrylamide, a carcinogenic chemical. Food producers in Europe are required to keep acrylamide content below acceptable levels, although researchers still don't know whether burnt toast poses a threat to human health. Either way, Professor Halford, a crop scientist at UK non-profit Rothamsted Research, believes wheat is in need of an upgrade and that means reducing the potential for acrylamide to form.

Professor Halford and his team have tried various tactics since embarking on the project in 2004, but in the last couple of years have


Rothamsted Research

01

Younger generations are more supportive of GM crops

Survey of 1,600 UK adults aged 18 to 30

67% agree that GM crops can play a major role in making UK farming more sustainable for the future

20% object to the use of gene editing in agriculture

Populus 2018

been employing a new approach. CRISPR is a pioneering gene-editing tool which enables scientists to make precise changes to an organism's DNA. Typically, researchers might remove part of the genetic code responsible for an undesired characteristic. In wheat, it's believed that high levels of acrylamide production can be linked to a specific gene. "We're trying to knock that out," says Professor Halford.

CRISPR gene editing has only been possible for six years, but the technology has already shown the potential to transform the world's food supply. Safer wheat is just one possibility. Gene editing could create crops that stay fresh longer and are resistant to disease, insects and extreme environments.

It has been used to develop mushrooms that don't bruise, high-yielding corn and soybeans packed with healthy oils. Traits like these could be achieved using traditional plant breeding or existing biotechnology, but Dr Tina Barsby, chief executive at crop science company NIAB, says: "Gene editing is so much faster. Years faster. When you're talking about feeding the world, that's important."

> **You end up with a plant that's identical to the plant you started with, but it has one small change**

Of course, genetically modified food promised similar benefits when it came to the market almost 25 years ago. Then came the panic over so-called "frankenfoods", a public backlash and the introduction of strict regulation in markets including the European Union.

Gene editing is a different proposition. Professor Wendy Harwood, senior scientist at the John Innes Centre research institute, who is working to develop drought-resistant barley, says: "The value of gene editing is the precision, but also the range of things you can do."

Unlike genetic modification, which typically involves inserting foreign DNA into an organism's genetic code, scientists say gene editing is largely used to speed up the natural breeding process. "You end up with a plant that's identical to the plant you started with, but it has one small change," says Professor Harwood. "The same thing could have happened naturally."

However, hopes that gene editing might herald a new dawn in the field of crop science were dealt a blow in July when the European Court of Justice ruled that gene-edited products should be treated as genetically modified organisms (GMOs) and subject to stringent regulation that predates the CRISPR technology. While laboratory work will be largely unaffected, researchers say the ruling will make it almost impossible for European companies to bring gene-edited foods to market.

For Professor Halford, who hopes one day to see low-acrylamide wheat products on sale to consumers, "it was a hit in the head", he says. While European politicians could still decide to amend GMO regulations to exclude gene-edited crops, some experts in the field believe negative public perceptions of crop science makes such a scenario unlikely.

Professor Huw Dylan Jones, chair in translational genomics for plant breeding, at Aberystwyth University, says: "There aren't that many votes in support of biotechnology. It's easier to keep your mouth shut."

If the ruling stands, it will put the EU out of step with other markets around the world. In Canada, crops are regulated on the basis of the traits present within them rather than the method used to produce them. Argentina, China and the United States have all adopted a light-touch regulatory approach to gene editing.

In March, the US Department of Agriculture said gene-editing tools would not be regulated, while noting "they can introduce new plant traits more quickly and precisely, potentially saving years or even decades in bringing needed new varieties to farmers".

> **Gene editing could create crops that stay fresh longer and are resistant to disease, insects and extreme environments**

Major biotech firms including Monsanto, Syngenta and DuPont Pioneer are all investing heavily in gene-editing technology and this investment is being focused in markets where there are fewer regulatory hurdles to innovation.

Syngenta says its gene-editing research is largely taking place in China and the US. "We naturally chose to co-locate our main research resources in genome editing in those countries which are supportive of seeds technologies, and consequently host the main weight of leading academic organisations and companies working in the area," the company says.

In the US, smaller firms such as Benson Hill Biosystems and Cibus have also entered the market and are developing products including more resilient cacao trees and disease-resistant rice.

Stefan Jansson, head of plant physiology at Umeå University in Sweden, says this kind of innovation is now unlikely to happen in Europe. "Anyone who is really trying to help the world and make plants that are better suited for unfavourable conditions will have problems because now they can't commercialise their products," he says.

Producers in the US are racing to bring a gene-edited soybean to the commercial market. Meanwhile, the future for gene-edited foods in Europe looks doubtful. Professor Halford believes he is close to producing an improved variety of wheat, but this achievement will be tarnished. "We won't be able to do anything with it," he says.

In the UK, the fate of gene-edited foods appears to have been decided before most consumers have even heard of the technology. "They won't get the choice," Professor Halford laments. ◆

01
Professor Nigel Halford from non-profit Rothamsted Research is working to gene edit wheat to eradicate carcinogenic chemicals when cooked

02
Crop scientist at Rothamsted Research


02

Rothamsted Research

WASTE

It's time to change the word on waste

Food "waste" should be rethought as a valuable resource which can be used to create value and combat climate change


Tom Moggach

JIM McCLELLAND

Despite population growth and increasing famine, 1.6 billion tonnes of food is lost or wasted worldwide, every year. With an estimated carbon footprint of 3.3 billion tonnes, this wastage eats up 28 per cent of the world's agricultural area and drinks enough water to fill Lake Geneva three times.

"If food waste were a country, it would be the third biggest emitter of greenhouse gases after China and the United States," says David Green, director of the US Sustainability Alliance. "One third of food produced on the world's farmland goes uneaten. That is too compelling for food growers, producers and farmers to ignore."

The word "co-products" highlights how the language of waste is changing. He explains: "In California, almonds are not only a healthy nutritious tree nut, but the hulls and shells are useful co-products to ferment beer, boost mushroom production, even supplement honeybee food."

Slaughterhouse waste – fat, bones, tissue, blood and offal – is another, less palatable, but no less profitable, area of business.

Rethinking so-called food waste as a resource, complete with its nutrients, water and energy content, is also transforming the business model of the waste industry itself, says Dr Adam Read, external affairs director at SUEZ Recycling and Recovery UK.

"For our commercial customers, there is huge potential value to be derived from surplus and discarded food along the entire supply chain, as well as through avoidance of any associated wastes arising during production, handling and transportation," he says.

However, real progress on the household front would require mandatory, harmonised food waste collections. He says: "This would see food waste captured at source, which would not only give the sector confidence to invest in infrastructure, but also educate consumers and businesses alike."

Policymakers and legislators have a core role to play, agrees David Newman, president of the World Biogas Association (WBA). "We have all the technologies we need, but still waste 30 to 40 per cent of all food," he says. "The most important factor making innovation happen on the ground is policy; this means taking our commitments to climate change, sustainable development, soil, water and air quality seriously."

Produced in conjunction with C40 Cities Climate Leadership Group, the WBA *Global Food Waste Management Report* shows how cities can be success stories, with Milan, for instance, achieving an 86 per cent food capture rate.

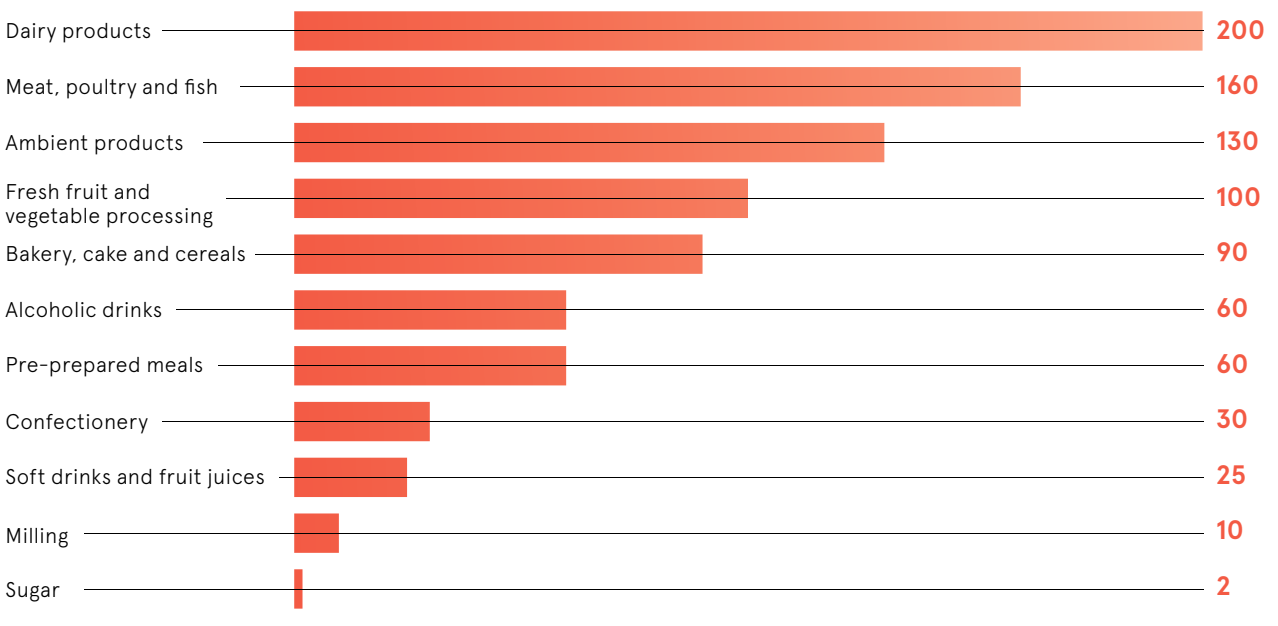
Business leaders, brands and global corporations are also increasingly engaged in food waste solutions, as evidenced by last month's Waste to Wealth Commitment Summit, attended by the Prince of Wales.

Toast Ale is craft beer brewed with surplus fresh bread that would otherwise be wasted

> **Rethinking, repurposing and reselling waste as a resource is fast becoming a hotbed of entrepreneurial activity**

Avoidable food waste in manufacturing and retail

UK estimates for annual avoidable waste by manufacturing sub-sector (thousand tonnes)



WRAP 2017

It is not only big business rethinking waste as a resource, though, says Richard Gueterbock, marketing director of Clearfleau Group. "A growing number of smaller food businesses are now recognising that generating biogas on the factory site can both cut carbon emissions and save costs," says Mr Gueterbock.

In anaerobic digestion, the language is changing, too. He adds: "We avoid using the word 'waste'. Everything in the food chain has a latent energy value."

An on-site bioenergy system can extract up to 95 per cent of available energy from a range of food processing residues, with installations at UK factories making everything from cheese and malt whisky, to Rolos and Fruit Pastilles.

Indeed, rethinking, repurposing and reselling waste as a resource is fast becoming a hotbed of entrepreneurial activity, says Louisa Ziane, global brand director at Toast Ale. "There has been a huge surge in startups using ingredients and materials that are surplus or a by-product," she says.

Toast Ale is an award-winning craft beer brewed with surplus fresh bread that would otherwise be wasted. All profits go to Feedback, an environmental food waste charity.

Food waste solutions are evolving sector-wide, says Ms Ziane. "Technology is improving our ability to measure and take action to reduce overproduction and reuse by-products and surplus," she says. "For example, Winnow [food-waste initiative] technology helps commercial kitchens to measure and monetise their food waste."

Sustainable restaurant champions range from Silo Brighton, a zero-waste pioneer "designed with the bin in mind", to the Michelin-starred kitchen of chef Diego Gallegos at Sollo Restaurante, set within a Hilton brand hotel, near Malaga.

In some ways, drinking rather than eating out is where previously hidden food waste solutions are now emerging.

"The problem with bar waste is real and there are no excuses," says Bex Almqvist, global marketing manager on trade at Absolut Vodka and co-creator of the Green Hustle. The Green Hustle is all about changing mindsets among bartenders to get them applying easy sustainability hacks.

She explains: "Almost every bar in the world uses lime, for example. The lime is squeezed, the juice is used and the husk is thrown away. However, if you make lime stock from your husks, you can stretch the lime by 50 per cent." Experience running a London cocktail bar tells Ms Almqvist this hack alone could have saved around 60,000 limes a year.

Sometimes, big ideas require us to think small. Home-delivery innovators Silly Greens are actually thinking micro, part-passing food production on to the end-user. Founder Ed Hall explains: "Micro greens don't even fit within the supply chain because they perish and lose their flavour and nutrition so fast. Therefore, perhaps living salads and growing that highly perishable food yourself is the answer."

Innovation abounds in rethinking waste as a resource. It ranges from valorisation of compostable plastics and catalysing into chemicals, to consumer smartphone apps, such as Olio and Too Good to Go, for food-sharing and rescue. The word on waste is changing. ◆

RESTAURANTS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Cooking up a restaurant renaissance

According to recent research by FleishmanHillard, 91 per cent of customers say food is part of their values and belief system, but many restaurants are struggling

FRAN CASSIDY

After a period of voracious interest, it looks like people's appetite for restaurants may be waning, especially in the UK. Even millennials, the generation that has dined out the most in recent years, are visiting restaurants less frequently. According to research by hospitality platform Flyt, they are the most likely to be eating out less than last year and the amount they spend when they do has gone down by 3 per cent, costing the industry around £800 million a year.

One reason for this shift is the cost of food itself, both for restaurants and customers. "These are the most challenging times that I have seen in my 20-plus years in the industry," says Maurice Abboudi, executive director of K10 restaurants and former chairman of orderTalk, an online ordering platform acquired by UberEats earlier this year. "The exchange rate is making imported food more expensive, there has been inflation of food costs over the past few years, rents and rates are unsustainable, and labour costs are rising."

For customers, this price elevation has meant that visits to restaurants have become a luxury, rather than a lifestyle choice, and many food and beverage brands are pivoting their service to reflect this. In the commercial sphere, drinks giant Diageo recently sold 19 of its lower-end brands for $550 million to focus on its premium business in a bid to increase slowing sales.

In the restaurant sector, many brands are choosing to add high-quality items likely to appeal to more discerning customers. "A lot of it has to do with knowing that better options exist in the first place," explains Amir Gehl, founder and owner of luxury coffee company Difference Coffee. "When given the choice, you will find a good selection of people opting for high-end specialty coffees at restaurants, much in the same way that people are aspiring to eat better food and drink better wines."

One unexpected example of the move to premium is Dunkin' Donuts. Rebranding as Dunkin', the multinational has dropped unpopular items, adopted a sleek new ordering system and introduced an espresso menu to feed customers' insatiable coffee demand. With a view to challenging Starbucks on price and efficiency, the company is also investing heavily in a beverage-first concept, with new nitro-brewed coffee taps and mobile ordering drive-thru lanes set to launch in 2019.

There is also an increasing focus on provenance and supply chain as consumers' ethical resolve shows no sign of abating. Results from PR and digital marketing agency FleishmanHillard's *Shaping the Future of Food* survey showed a growing sense of responsibility over improving the foods we eat and a duty to share this information. For restaurants to re-engage consumers, the ethical element of food production must become a top priority.

"People are much more engaged and knowledgeable about food, where it comes from and how it's prepared, and this has made people more sceptical and easily critical of restaurants who fall short," says Leanne Masi, owner of healthy street food business Luna & Fennel.

San Carlo, Italian rooftop restaurant at Selfridges, London

One big mistake some businesses have made, explains Mr Abboudi, is reducing the quality of the product or "menu-engineering" an item to a cost, rather than focusing on serving a great product. "Don't cut back on what people go out for: great food and great service," he says.

Ms Masi adds: "Brands need to focus on a key concept and execute it well. To appeal they must offer a good range of dietary alternatives, use high-quality ingredients, source locally as much as possible, and factor in environmental and ethical concerns."

A more discerning, ethically minded, cash-sensitive consumer base may seem an insurmountable obstacle for many restaurants, but there are key things which can make mid-market brands more competitive. And the first is marketing.

"Restaurants need to make eating out an experience," says Nadia Leguel, UK business director at Bookatable by Michelin. "They need to touch all the senses, not just focus on product. High street brands are losing appeal because they always have the same offering. It's not cool to post a picture of a meal at a chain restaurant because there are so many people all over the country eating the same thing."

> **They must offer a good range of dietary alternatives, use high-quality ingredients, source locally as much as possible, and factor in environmental and ethical concerns**

Brands would be remiss to underestimate the power of social media marketing in revitalising ailing brands. Struggling with falling visitor numbers, American diner-style chain Denny's adopted a social media strategy, which relies heavily on pop culture and meme humour to stay culturally relevant and appeal to the young crowd they welcome through their doors. And it seems to be working, with total operating revenue up 3.1 per cent in the third quarter of this year and two new UK branches opened since 2016.

Most crucial to survival of mid-level restaurants, however, is embracing the opportunities offered by technology. A powerful resource in any industry, in the restaurant business it can be the difference between keeping and losing customers, and those brands that choose to innovate can change the sector itself.

Ten years ago, London restaurant inamo did just that. Noel Hunwick and Daniel Potter had an epiphany while struggling to catch a waiter's attention at a friend's birthday. "We wanted to buy more and give the establishment our money, but they weren't letting us," says Mr Hunwick. The result was their patented E-Table technology, which enables customers to order food, call a waiter or get their bill through the interactive table set-up.

Beyond the basic dining experience, customers can also play games on the table, change their virtual tablecloth and peek into the kitchen through the live chef cam. Most importantly, however, they can give feedback on the dishes and service, right there and then.

"We always knew that to stay relevant, the quality of the experience had to be measured as a whole, not only the concept's edge," says Mr Hunwick, adding that this feedback has helped measure team performance, reduce the turnover time for tables and even drive up average spend by making it easier for guests to order more dishes. The Soho branch of inamo is now achieving 16 per cent revenue growth year on year.

Innovative technology is part of inamo's brand, but other restaurants need not embrace such an all-encompassing strategy to see signs of improvement. The clear value of the interactive table lies in the benefit to the customer. Beside reassessing the offering and remaining competitive on prices, restaurants must put a stronger focus on customer experience if they are to survive.

In the era of one-click ordering and next-day delivery, customer expectations of service are high. A lack of ease in ordering, difficulty splitting the bill and long waiting times are all elements of the customer experience that can stand in the way of repeat business. For restaurants to thrive, they must use every tool at their disposal to put the customer at the heart of everything they do.

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