safefood Knowledge Network

THE FOOD CHAIN

THE *safe*food KNOWLEDGE NETWORK NEWSLETTER ISSUE No.26 APRIL 2023

AGRI-FOOD GOES DIGITAL

Expert focus: Aidan Connolly explores the exciting and innovative applications of Artificial Intelligence in the food industry

As with so many things, the pace of change in the food industry is increasing rapidly and agriculture is not immune to the changes of the digital age. Technological innovations can transform every link in the food chain, from seed to fork.

Digital technologies are transforming the business (robots, augmented reality, virtual reality, 3D printers, data analytics and sensors, drones, blockchain, Internet of Things and cloud computing), but they all have one thing in common: Artificial Intelligence (AI). AI is the secret code or sauce behind them all.

AI refers to the collection of data from sensors and its conversion to comprehensible information. AI machines can mimic human cognitive functions such as learning and problem solving, and interpret information more efficiently than humans, reducing their need to be involved.

An exciting example in agriculture is machine vision, whereby computers process visual data collected via unmanned aerial vehicles (drones), satellites or even smart phones and provide the farmer with useful information.

Aidan Connolly

For example, Labby Inc is a startup which has spun out of one of America's leading Universities, MIT, and is using AI to analyse the data from milk sensors to detect changes in milk fat, protein and even somatic cell counts. Cainthus processes images from camera images of cows and has developed algorithms to identify animal behaviour, feed availability and productivity in dairy herds. AI can interpret information far better than humans, with fewer mistakes or without misassumptions that humans make, allowing the user to make better informed decisions.

AI can also be self-learning, and progress beyond human abilities, but as we have seen in other industries, such as hospitals, its real power is to make people better at their jobs, not to replace them. The use of AI to advance food production

"AI OFFERS THE OPPORTUNITY TO INCREASE TRACEABILITY AND CONSEQUENTLY, CONSUMER CONFIDENCE."

is accelerating as the world progresses post-COVID and expectations of speed and efficiency, as well as sustainability, are ever-increasing, even as the global population grows rapidly.

Here are examples of actors in the food industry who have introduced AI, and how it has accelerated their growth, or even changed the way in which they operate.

Food Safety

Reducing the presence of pathogens and detecting toxins in food production is a key avenue for AI. The Luminous Group, a UK software firm, is developing AI to help prevent outbreaks of pathogens in food manufacturing plants, limiting consumer illness or recalls.

Additionally, AI offers the opportunity to increase traceability and consequently, consumer confidence. For example, Remark Holdings, a subsidiary of data intelligence platform, KanKan, consisting of AI-enabled cameras in Shanghai's municipal health agency checks that workers are complying with the safety regulations. This algorithm-based machine learning technology includes facial and object recognition, and "sets the foundation (...) to potentially triple [their] business with the city of Shanghai," according to Remark Holdings Chairman and CEO Kai-Shing Tao.[1]

More recently, the company added improved facial recognition abilities to account for the mandatory use of a mask. It also introduced a new body temperature detection solution, in response to the effects of COVID-19. By detecting increased body temperatures, this new technology could help in the early detection of a COVID case. The ever-evolving project shows an ability to constantly grow and develop, a flexibility that is essential today in the world of technology.

Additionally, Japanese technology company Fujitsu has developed an AI-based model which is used to monitor hand washing in food kitchens following strict regulations set by the Japanese health ministry. This technology will reduce the need for visual checks (critical during COVID) where food safety must be increased.

Next-generation sequencing (NGS) is also another attempt made by food safety associations to increase the accuracy and speed with which any threats to food safety are identified and addressed in a production chain.

AI can be used for 'Cleaning in Place' projects, which aim to use AI to clean production systems more economically using more environmentally friendly methods. In Germany, a project by Industrial Community Research strives to, "develop a self-learning automation system for resource-efficient cleaning processes." This makes up a cleaning process without a need for the disassembly of equipment. This could cut labour costs and time spent on it, as well as increasing the safety of food production in the plant in question by removing the opportunity for human errors.

The University of Nottingham has also been working to construct a self-optimising Clean-in-Place system, which uses AI, "to monitor the amount of food and microbial debris in the equipment."

Processing

The processing of food is a labour-intensive business, but one where AI can maximise output and reduce waste by replacing people on the line whose only jobs are to identify items unsuitable for processing. Decision-making of this type at speed requires the senses of sight, smell, and their ability to adapt to changing circumstances. AI brings even more to the table through augmented vision, analysing data streams either unavailable through human senses, or in what one Washington DC-based organisation says, the information is so 'data-rich that retailers cannot process it in a meaningful way to prevent product contamination or another outbreak'.

TOMRA, a manufacturer of innovative sensor-based food sorting systems, is incorporating AI technology into its processes to detect abnormalities in vegetables and fruits, including sensor-based sorting machines, detecting and removing any types of foreign materials from its lines of produce, reacting to changes in moisture levels, colours, smells, and size. TOMRA's primary focus is reducing food waste, for example they claim the recovery in potato processing of "5-10% of produce through higher yields and better utilisation", equivalent to "25,000 trucks of potatoes per year". TOMRA is currently developing meat processing applications.

Another example is how Japan's food processing company Kewpie uses Google's Tensorflow AI for the detection of defective ingredients during processing. It was originally used for the sorting of foods, and gradually developed into an anomaly detector, which could then be used for unsupervised learning, saving both a large amount of time and money. While focused on diced potatoes as of yet, the company plans to, "expand to eggs, grains, and so many others."

Dutch company Qcify offers automated quality control and optical monitoring solutions for the food processing industry. It uses machine vision systems to classify almonds, pistachios and other nuts. It claims to be able to identify quality at twice the speed of a human operator and more importantly to automatically remove impurities or foreign objects, and automatically generate quality reports.

A myriad of other agritech start-ups are focused on using AI to detect early warning signs of poor health in crops that may have otherwise been overlooked, which can further reduce the waste in food production, in addition to increasing transparency.

Supply Chain Efficiencies

The food ordering and delivery app, Uber Eats is now incorporating AI to make, "recommendations for restaurants and menu items, optimise deliveries", as well as looking into the use of drones. They use Michelangelo, Uber's machine learning platform, for various tasks. For example, this can predict meal estimated time of delivery (ETD) to reduce waste and improve efficiency throughout its delivery process. While this application is post-food production, once food has been produced, there are many more ways to implement this up and down the chain.

COVID-19 has accelerated the applications of technology to replace human labour and while smart device food apps, drone and robot delivery, and driverless vehicles all provide new ways to get information and food to the consumer, all of them depend upon AI.

Innovative uses of AI are crucial in moving towards reducing the quantity of food wasted to feed the growing world population as efficiently as possible, as well as falling in line with increasingly specific consumer demands and expectations. Supply chain forecasting company Shelf Engine employs AI to remove human error while working with perishable foods from the purchasing function and make more informed decisions about order sizes and types in hundreds of US stores and has saved thousands of dollars in food waste. Wasteless is a machine learning and realtime tracking solution that allows retailers to use dynamic pricing to discount produce before it goes past its sell by date.

Overcoming the Odds

Alongside all the positive aspects of AI, some see it as a technology with the goal of taking over human jobs, and that creates controversy. The fear of the unknown is creating a pushback against the use of AI in many businesses. Additionally, AI requires skilled IT professionals, who are in high demand and difficult to recruit. Clearly, there are costs to retraining programmers to adapt to the change in skills required. Finally, the cost of implementing and maintaining AI is very high, which may limit the opportunities for smaller or start-up business to compete with already established larger ones. Downsides such as these could possibly slow down the speed with which AI transforms food production, but given the absolute power unleashed by AI in a post-pandemic food world, it is unlikely to be more than a speed bump on its eventual universal acceptance.

ABOUT AIDAN CONNOLLY

Aidan J. Connolly is a contributor to *Forbes*. He teaches at three Agri-Food MBA programmes, and is Adjunct Agribusiness Professor at China Agricultural University. He is President of AgriTech Capital, advising on innovations and technology investments. His most recent book *The Future of Agriculture* is a free download at www.agritechcapital.com/books

1 www.fastcasual.com/news/restaurant-safety-check-new-ai-platform-watches-reports-violators/

NAVIGATING FOOD SAFETY TESTING AND REGULATION

New legislation requires new technologies and Una McCormack, Technical Consultant with Mérieux NutriSciences, explains the implications of the new maximum levels of per- and polyfluoroalkyl substances

Una McCormack is a Technical Consultant with Mérieux NutriSciences, a Kildare-based company offering practical testing and consulting to food and beverage manufacturers, processors, caterers, and retailers.

Una McCormack

A native of Ennistymon in county Clare, Una studied Applied Science Microbiology in GMIT. After graduation, she joined Dairygold CMP (Cork Milk Producers) Dairy Laboratory.

"It was a liquid milk plant in Cork city which produced a range of dairy products, and my first role was a laboratory technician. Later in my career, I was promoted to laboratory manager." Her daily duties included the routine testing of milk and dairy products, and as quality manager, maintaining the quality system and supervising laboratory staff. Una moved to Nutrition Supplies, then Enva, and subsequently Advanced Laboratory Testing (ALT) where she worked in consultancy and sales.

Mérieux NutriSciences acquired ALT in 2019. "I am a Technical Consultant based in the Cork office, and my role is advisory. If you are a food producer and you need to get a product tested, I can advise on the tests required to comply with legislation or other food safety criteria. Shelf-life testing is part of the work we do. Products placed on the marketplace with a 'use by' date or a 'best before' date have to be shelf life tested and that's done through microbiological methods and laboratory testing."

Una's client base is across the full spectrum, ranging from small through to large food producers, and planned sampling and sample collections form part of her daily routine. "The results generated from our testing may need to be reviewed and communicated to the client in easy-to-understand terms." Constant communication with clients on testing queries, liaising with head office for sample collection scheduling, informing clients about procedures for sample handling, environmental testing i.e. swabs, water sampling, and administrative duties are all part of her working day.

The ongoing introduction of new food products and ingredients means there is no room for complacency, she says. "The advent of novel foods such as plant-based products, fermented products, and meat alternatives coming onto the marketplace and gaining popularity brings a new aspect to the role, requiring learning about them and the standards surrounding the production of them."

And Irish food operators are far from complacent, she believes. "The awareness of food safety is excellent in Ireland. The challenge for the food producer is learning how to meet the requirements. They know it has to be done, but we are often asked to help them go about it. If they have an inspection and they are advised to get sampling done to comply with legislation, a client may need assistance to proceed, and this is where I or ***safefood*** or the Food Safety Authority of Ireland can help them to move forward. We also work closely with independent food safety consultants who engage with clients directly in this regard."

Once testing is complete, understanding the results can present its own challenges. "Often what I hear is, 'I have my

"OFTEN WHAT I HEAR IS, 'I HAVE MY CERTIFICATE OF ANALYSIS, BUT I DON'T KNOW WHAT THE NUMBERS MEAN."

certificate of analysis, but I don't know what the numbers mean.'" While the role of a laboratory is primarily to analyse and report results, she says, food businesses, particularly smaller producers, cannot be expected to be familiar with all the technical and scientific terms used on a test certificate. "In addition, the legislation and guidelines may be daunting to read or understand initially. Clients need to be made aware of resources available and published guidelines. Accessing information for the client so that they can be reassured and fully understand what is required of them to comply with legislation or other food safety criteria is of the utmost importance. It's to help them understand their results so they can read them going forward." She highlights the training and webinars provided by ***safe*food** as hugely important and an easy-to-access resource.

One of the latest challenges facing the industry is the regulation for per- and polyfluoroalkyl substances (PFAS), a family of nearly 5,000 synthetic chemicals considered persistent contaminants. Used in the industry for their stability and oil-repellent properties, they are extremely difficult to degrade in humans and in the environment.

New regulation has introduced maximum levels of PFAS on certain foodstuffs, specifically products of animal origin: egg, meat, fish and their derivatives, making their determination mandatory in the concerned food products. In addition, the Commission Recommendation (EU) 2020/1431 extends the monitoring to a list of 28 analytes, also in fruits and vegetables and food for infants and young children, with very low target limit of quantifications (LOQ).

New legislation such as this requires new technologies and it's vital to get the test accredited as quickly as possible, she says. "Mérieux NutriSciences is proud to be the first laboratory in Europe accredited for PFAS testing with screening offered for the four main PFAS and offering the required limit of quantification of one part per trillion (1PPT) – extremely low levels in line with what is demanded by the legislation."

Allergen testing is another area that requires constant vigilance, she says, citing Natasha's Law. "It's critical to keep on top of that as more allergens come to the fore. Legislation is constantly changing, whether it's new allergens or new contaminants, and you have to keep up with it – last year's tests may not be sufficient for this year."

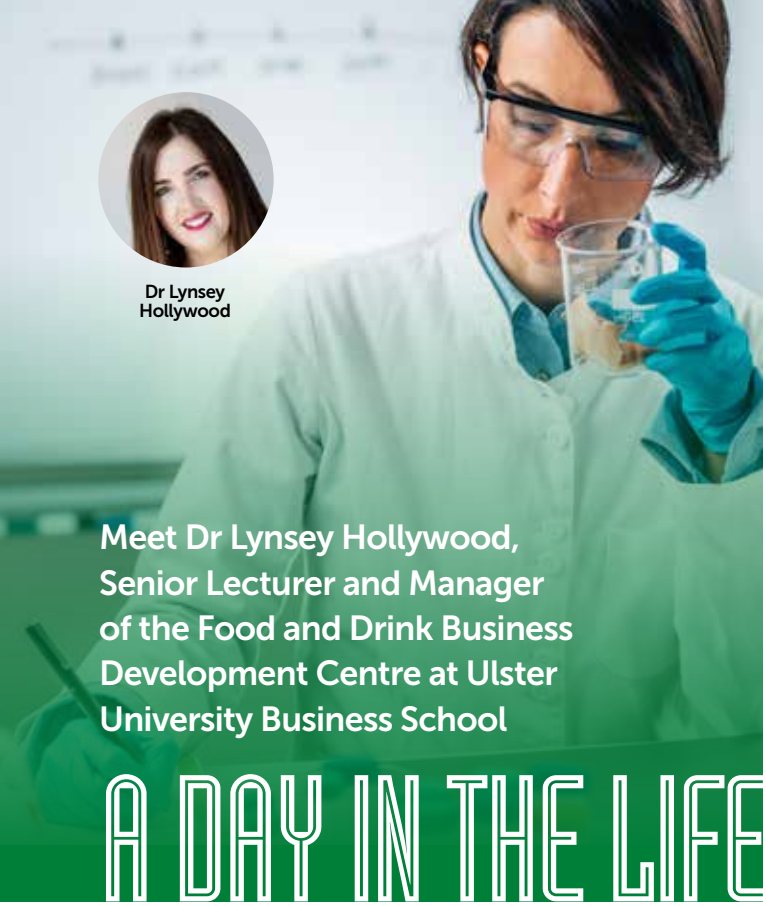
Food substitution is another area of concern. "Current circumstances, such as the war in Ukraine, mean that people are trying to source ingredients and materials from different and new suppliers. Food business operators might be used to a certain supplier with a specification, and moving to a new supplier means you may have to get packaging or ingredients tested before you use it."

MORE ABOUT UNA MCCORMACK

What do enjoy doing in your spare time?
I have a passion for food and cooking, I like spicy Asian flavours and shellfish pasta dishes.

Tell us about your hobbies.
I practice yoga, and I am flute player with a trad group in Cobh, Co. Cork.

What are you reading?
I recently started a book about Gráinne Mhaol and am thoroughly enjoying learning about the Pirate Queen of Connaught, a very determined woman, to put it mildly!



Dr Lynsey Hollywood

Meet Dr Lynsey Hollywood, Senior Lecturer and Manager of the Food and Drink Business Development Centre at Ulster University Business School

A DAY IN THE LIFE

Dr Lynsey Hollywood has had a keen interest in the food industry since taking Home Economics at school. She studied for a BSc in Consumer Studies and was awarded a NIFDA scholarship to study food marketing at Saint Joseph's University in Philadelphia. She was then offered a PhD scholarship in food marketing. "My PhD explored consumer behaviour in relation to the purchase of milk, to identify segments of consumers that could be targeted with added-value milk products. After my studies, I worked as a Lecturer in Business Strategy at Ulster University, then took up a post at Queen's University Belfast as a Research Fellow." Lynsey's next post was as lecturer on the BSc Consumer Management and Food Innovation degree at Ulster University. "I taught on this programme for five years and absolutely loved it." In 2018, she became manager of the newly established Food and Drink Business Development Centre which was created to harness and promote all the food-related research activity undertaken across the Ulster University Business School (UUBS). "I am currently involved in a range of funded research projects, five of which are ***safe*food** funded."

The aim of the UUBS Food and Drink Business Development Centre is to support local industry through academic and/or commercial research, and teaching. The Centre provides a range of facilities including the Consumer Insight Lab, which uses virtual reality technology to understand shopping behaviours; the award-winning Food and Consumer Sensory Testing suite for sensory evaluation and product development activity, and the Academy restaurant for testing menu concepts and upskilling. "We are in the process of launching our Market Intelligence lab which will house big data information, for example, shopper loyalty card data."

Research to date within the Centre has focused on the themes of food innovation and product development, food safety, food retail and consumer behaviour. "We recently completed two ***safe*food** studies addressing food safety. One study sought to understand consumers' use of meat thermometers and the other addressed consumers' use of smart devices while preparing food. Now, we have two ***safe*food** projects underway: one looks at how businesses are adopting to the new EU Legislation on food safety culture and the other is on foods that consumers bring to vulnerable patients in healthcare settings."

The ***safe*food**-funded project on Food Safety Culture (FSC) is a collaboration between the team at Ulster University, University College Cork, Queen's University Belfast and Dundalk Institute of Technology. "The term FSC has recently been included in the Commission Regulation 2021/382 which stipulates that all food businesses must show evidence of its implementation. Key attributes of a strong FSC include management systems, risk perceptions, leadership, communication, environment and commitment to ensure food safety. To date, there is limited academic research addressing FSC implementation therefore this study will explore whether a robust food safety culture exists among small food businesses on the island of Ireland and if not, why not?" Furthermore, she explains, the study will examine the attitudes and behaviours towards food safety culture amongst food business owners and staff and their commitment to prioritising it within their business.

Within the food safety culture project, Lynsey and her team have found that the demands faced by small food businesses mean they find it difficult to keep abreast of new legislative changes or updates and how they can implement these requirements. Additionally, high staff turnover and reliance on migrant staff means it can be challenging to ensure that their staff are up to date with their knowledge and understanding of food safety.

Lynsey believes the drive for sustainability across the industry can bring to light some key food safety issues. "While it is industry's desire to reduce food packaging, consumers increasing demand for recyclable and reusable packaging will continue to present a food safety challenge of ensuring products are still safe for human consumption if new types of packaging are introduced."

With the current 'cost of food crisis', the safety of food will become more important than ever as this, along with availability of ingredients, will affect supply chains, she adds. "Such demands may force businesses to identify new suppliers which may be further afield or based in other countries, meaning new standards and a clear understanding of their ingredient inputs and processing methods will need to be considered."

MORE ABOUT DR LYNSEY HOLLYWOOD

What hobbies do you enjoy?

I write a local food and drink blog called @Downthehatchni with my husband Robert. I also enjoy walking along the Down coastline.

What are you reading?

I am reading for the second time a book called *The 7 Habits of Highly Effective People* by Stephen Covey. Returning from maternity leave to working full-time and managing life with two little boys has forced me to focus on trying to make effective use of my time.

What are you currently watching?

I have just started watching the Belfast-based police drama called *Blue Lights* and am enjoying it so far.

NEWS AND EVENTS

Food Safety Training Workshops 2023

The ***safe*food** Knowledge Network will be hosting a number of free training workshops for small food businesses on 'Essential Food Safety' and 'HACCP & Record Keeping,' online and in various locations throughout the island of Ireland. The first in-person workshop on HACCP and record keeping will take place on Thursday, 11th of May in Athenry, in association with the BiaInnovator Campus. The second set of workshops will be held on the 25th and 26th of May in Belfast.

To register please visit **www.*safe*food.net/events.** For further information please email **knevents@safefood.net**

Food Safety Skills Fund

Learn more about bursaries to enhance food safety skills and experience. Did you know that if you're a member of

***safe*food**'s Knowledge Network that you can apply for our Food Safety Skills Fund Programme? The programme aims to enhance member's skills, broaden their experience and create linkages between those involved in food safety on the island of Ireland. The programme funds visits to other laboratories, and attendance at conferences, centres of excellence and other food safety training events. For more information or to apply please see **www.*safe*food.net/food-safety/skills-fund**

*safe*food and Special Olympics Ireland partnership

Pictured launching the Health@Play partnership are young athletes Sophia and Ross from Titanic Tigers Special Olympics Club.

In March, ***safe*food** and Special Olympics Ireland (SOI) announced a new partnership called Health@Play that brings health education through sport to children with intellectual disabilities aged 4-15 years within their community clubs and schools. Hayley Kavanagh, Special Olympics Ireland, said: "By introducing children to healthy habits through a wide variety of play activities in a familiar, supportive and fun environment, everyone has the opportunity to succeed."

Speaking about the partnership, Fiona Gilligan, Director of Communications at ***safe*food** said: "We are very proud of this new partnership between ***safe*food** and Special Olympics Ireland. The young athletes and their health coordinators have been wonderfully engaged in the development of the resource and we look forward to the roll out across the island of Ireland. We will continue to explore fun and engaging ways to educate children on the importance of eating healthily and how that connects with being active. Nurturing our children to develop these positive habits from an early age can give them the building blocks towards a healthy life."

QUIZ TIME

Try your hand at this issue's quiz and you could be in with a chance to win a fantastic prize!

Question 1
What is mageirocophobia?

Question 2
What variety of chili pepper is considered the hottest in the world?

Question 3
What is guanciale?

Question 4
What seafood has a 'beard'?

Question 5
What popular fruit contains malic acid?

Question 6
French Breakfast, Cherry Belle and Easter Egg are all varieties of what vegetable?

Question 7
In what country would you find 'seswaa' on the menu?

Question 8
What helpful tool did Ezra Warner invent?

Question 9
True or false: milk can be made into plastic.

Question 10
What herb beginning with C is mentioned in the bible?

Congratulations to Leona Hawkes, College of Agriculture, Food and Rural Enterprise (CAFRE) who was the winner of issue 25's quiz.

Answers:

1. ***Pomelo***
2. ***Rose***
3. ***Potato***
4. ***Fruit***
5. ***The sandwich***
6. ***Green***
7. ***Scottish cheeses***
8. ***Argentina***
9. ***12***
10. ***Its strong and unpleasant smell***

To enter: ***Simply complete the quiz above and send your answers to knowledgenetwork@safefood.net before 21st July 2023. This competition is open to Knowledge Network members on the island of Ireland only.***

Food safety training

***safe*food** for business is a free eLearning food safety tool for small businesses in the food industry, from manufacturing to catering, to service. It covers all aspects of basic food safety training for staff in eight short, practical and engaging modules using real-life scenarios and workplace activities. With ***safe*food** for business you can provide staff training and track their progress across any device as they work to achieve certificates of completion. Scan the QR code to sign up and access all the modules and resources to help keep your business food-safe. See **www.*safe*foodforbusiness.com**

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We'd love to hear from you. Would you like us to feature your research or industry sector? What else would you like us to cover in the world of food safety? Send your article ideas, feedback and suggestions to **knowledgenetwork@*safe*food.net**

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