Appetite Learning

Beyond 2017:

Utilising technology to maximise food safety in manufacturing

Using automation, data, smart packaging & e-Learning to make your food business stand out as a food safety leader.

Contents

Whilst 2016 was certainly a year of change for the food manufacturing sector, 2017 has managed to top this by throwing even more upheaval at the industry. With the socioeconomical fallout from Brexit still causing uncertainty, plus announcements entailing a complete overhaul of how the industry is regulated and a number of food safety scandals involving big players like 2 Sisters Food Group – 2017 so far has been tumultuous to say the least.

It is becoming clear that despite the public image of commitment to food safety by manufacturers, many businesses are still cutting corners in this area, due to ever-increasing pressure to reduce costs and maximise profit. At a time when the emphasis from bodies like the Food Standards Agency seems to be on self-regulation, manufacturers need be proactive and seek out systems that will not only streamline costs, but decrease the length of time that passes between a food safety incident and it's detection.

Technology's capacity to fulfil this has already been demonstrated in spades. With a smartphone, we can now remotely monitor data and take action in just a few taps, be it to trade shares, track the numbers of steps taken a day or to turn down the heating at home.

Investment in technologies by food manufacturers must always be considered in the context of the changing food safety landscape and, in particular, how the technologies will help them stand out to regulatory bodies for the right reasons.

This paper outlines some crucial upcoming changes to the way we 'do' food safety regulation and looks at a few technologies presently being utilised by forward-thinking players in the food manufacturing sector, with real life examples. These include robotics and automation, on-line monitoring tools, smart packaging and e-Learning systems.

A TURBULENT TIME

The Last 6 Months in the Food Manufacture Sector

August 2017: Around 700,000 contaminated eggs reach the UK from Dutch farms using fipronil. Despite the FSA stating that it was very unlikely the eggs posed a risk to public health, the scandal receives large amounts of media attention for the whole month.

October 2017: Parliamentary inquiry launched into 2 Sisters Food Group, after a joint investigation by ITV and The Guardian revealed a plethora of food safety breaches, which dominated the media headlines.

itv **theguardian**

July 2017: The Food Standards Agency publishes the plans for "Regulating our Future", which details a massive overall of the way food businesses are regulated.

July 2017: The British Poultry Council rejects a US-UK trade deal, which would allow the import of chlorine-washed chickens after Brexit.

June 2017: A survey by Food Manufacture finds that pressure to meet tight production deadlines causes food workers to cut corners, putting food safety in jeopardy.

FOOD manufacture

April 2017: The manufacturing sector reacts to the official start of Brexit: Nestlé announces plans to move its Blue Riband production to Poland, cutting 298 jobs. Manufacturers raise concerns about the potential labour crisis leaving the EU will prompt, whilst some look forward to the export opportunities Brexit might provide.

March 2017: Prime Minister Theresa May triggers Article 50, marking the start of the two years until the UK officially exits the European Union.

To understand how particular technologies can improve compliance we first have to look at the manufacturing industry in 2017, understand where food safety currently is and where it's going.

It is easy to be assumptive about the standard of food hygiene practices in the UK's manufacturing sector but ultimately many businesses are still not towing the line when it comes to ensuring food is safe before dispatching it to the public. Consumers are still falling ill, often with fatal consequences, because of manufacturers neglecting their responsibilities for food safety:

- In 2016, a three year old girl from Dunbartonshire died during an E.coli outbreak linked to manufacturer Errington Cheese[1]. 20 cases of E.coli 0157 were confirmed in July 2016 and in March 2017 it was also established that the source of the outbreak was a blue cheese produced by the manufacturer.
- In May 2017 a nine year old girl with a dairy allergy died after eating one bite of a dairy-free pancake her father had made her at home. Although the source of the reaction has not yet been identified, the family never kept dairy products at home and suspect one of the ingredients had been contaminated[2].

Additionally, some manufacturers are not taking steps to scrutinise the food safety practices of businesses supplying their ingredients, allowing hazards to enter the supply chain. In August 2017, recalls of chicken and poultry products were at a 15-year high with 66.5% of these concerning product and ingredients produced in non-EU countries[3].

Food safety failures and their effects often make headlines in the UK, but the media attention surrounding the scandal that engulfed the 2 Sisters Food Group in October 2017 demonstrates just how quickly a health and safety disaster can spiral into a PR one. A joint investigation by The Guardian and ITV resulted in undercover footage showing workers at the 2 Sisters plant in West Bromwich altering source codes and kill dates of chicken, as well as chicken from the floor being put straight back onto the production line[4]. Now subject to a parliamentary investigation, it's not so much the food safety practice itself (or lack thereof) that has caused such uproar but the fact that a trusted brand, who supplies produce to big UK supermarkets, should be able to get away with not meeting very basic standards. Questions are inevitably raised – for what length of time has this gone undetected? How can this happen? Can a regulatory system that does not identify issues like this straight away really be fit-for-purpose?

Regulating Our Future

"There is a fundamental weakness in the current model as the FSA doesn't know in real time how many food businesses actually exist or who is operating them" – **Regulating Our Future paper, FSA, July 2017**[5]

In the past couple of years the Food Standards Agency have spoken of revolutionising the way food safety is regulated, stating the current system is not keeping pace with the technological change in the food industry. In that time the UK has left the European Union, and consequently any proposed changes must now seek to maximise confidence in the UK food industry when it becomes a non-EU player on the world stage.

In July 2017, the FSA finally released a paper covering why food regulation needs to change, as well as how they intend to do it – with full delivery of the new system coming into effect by 2020. It outlines a complete overhaul of the current system, placing more responsibility for demonstrating the production of safe food into the hands of businesses themselves. Additionally, the FSA will set standards so the expectations of food businesses are transparent and various third parties, including local authorities and private auditors, assess food businesses on the same set of criteria.

The new system undoubtedly seeks to move the authoritarian relationship between the FSA and food businesses to one of mutual trust and openness. But what does this actually mean for food manufacturers and their bottom line?

In short:

- Businesses will be given choices on how to demonstrate compliance.
- Food businesses will meet the costs of regulation (which shouldn't be more than it needs to be).

- More emphasis will be placed on private assurance schemes, as it frees up local authority resources to deal with businesses putting the public most at risk.
- There will be better recognition of those who demonstrate sustained compliance.
- Equally, those who do not demonstrate compliance will be dealt with swiftly and severely. Businesses requiring the most intervention from government will pay the highest costs.

The FSA plan to measure the success of this new model using a variety of data including hospital admissions for food allergies, reduction of admin for compliant businesses and improvements in risky food businesses amongst other less tangible data like public trust.

Despite Regulating Our Future being in its early stages, its already become clear that earned recognition plays a massive part in the new model and holds plenty of opportunity for manufacturers ready to take more responsibility.

Earned Recognition

Another key theme in the FSA's recent collateral on changes to their regulation model is the idea that earned recognition should see businesses who do things the right way rewarded more for their compliance. Although earned recognition has been a buzzword in the food manufacturing landscape for several years, it currently represents an increasingly risk-based, self-regulatory approach to inspections. Obviously, this fits in nicely with what the FSA are trying to achieve with Regulating our Future and the term is now set to become more widely used with regard to food businesses that demonstrate compliance with both the law and third-party audits[6].

What do the experts say?

Speaking at Food Manufacture's Food Safety Conference 2017[7], food safety consultant John Barnes said there was a 'massive opportunity' for manufacturers to benefit from earned recognition.

"The regulation is about changing behaviour and it's about the FSA working much more with industry. You are going to have more responsibility for regulating the supply chain. It will mean being more formally recognised and potentially rewarded, or penalised where you're not doing the right thing."

His advice to manufacturers? *"Look at your current food safety arrangements and just make sure they are in the right space, and that they've got credibility."*

Earned recognition also seeks to make food safety non-competitive, with food businesses across the UK's manufacturing sector working together by sharing data to protect consumers from food hazards. Whether this is possible remains to be seen, but its clear manufacturers need to consider investments that will give them the credibility they need to receive the right sort of acknowledgement from the FSA.

With automation, real-time data monitoring and robotics becoming increasingly present on the shop floors of UK manufacturing businesses, technology is already helping forward-thinking businesses achieve this.

Processing Technologies

It is fair to say that the food manufacturing sector has been somewhat reluctant in embracing the Internet of Things. But improvements the IoT stands to bring to crucial elements like food safety is making it harder to ignore and many forward-thinking businesses have implemented technology in their factories to monitor data in real time.

What is the Internet of Things?

The Internet of Things (IoT) refers to everyday devices where data can be collected and exchanged with little or no human intervention.

What can this be used for in food manufacturing?

Reducing food waste

Improving traceability

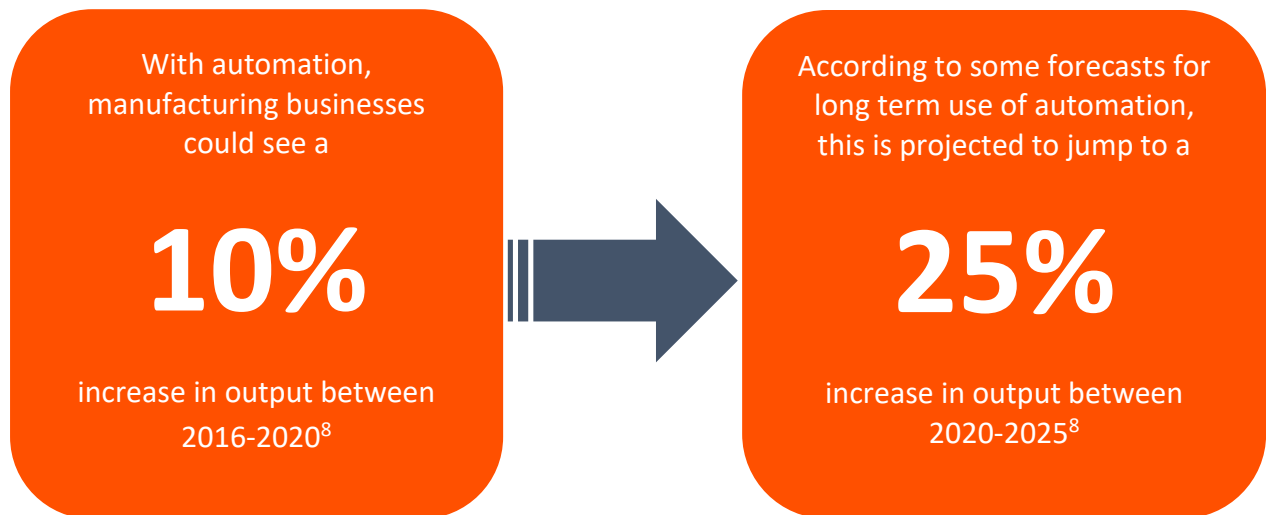Optimising equipment

Improving data collection

Improving food safety

A technological change that food businesses have been quicker to embrace is automation, most likely due to its streamlining capabilities.

Manufacturing Robotics and Automation

A study in 2015 by Barclays[8] suggested that 58% of UK manufacturers were already investing in automation technology; this has undoubtedly increased as more businesses have seen improvements to both efficiency and cost from these type of investments. In 2017 it was estimated that the value of the global food automation industry would hit $2.5 billion by 2022[9].

With automation, manufacturing businesses could see a

10%

increase in output between 2016-2020[8]

According to some forecasts for long term use of automation, this is projected to jump to a

25%

increase in output between 2020-2025[8]

According to robotics supplier Robotiq[10] some examples of how robotics might be applied in the food manufacturing sector includes:

- Fruit and vegetable pick and place
- Cutting and slicing
- Cake decorating
- Pizza making
- Butchery, for example high-volume chicken leg deboning robotics.

This last example in particular goes to show how far robotic technology has advanced in the food manufacturing sector. It used to be a firm-held belief that machines could not possibly replicate intricate butchery, particularly on beef and lamb carcasses. Yet in 2016, New Zealand meat processor JBS partnered with Scott Technology as they rolled out a range of meat processing bots, which can carve different cuts from lamb, beef and pig carcesses[11]. Also available are complete automated boning rooms (pictured), which are able to process 12 carcasses per minute[12].
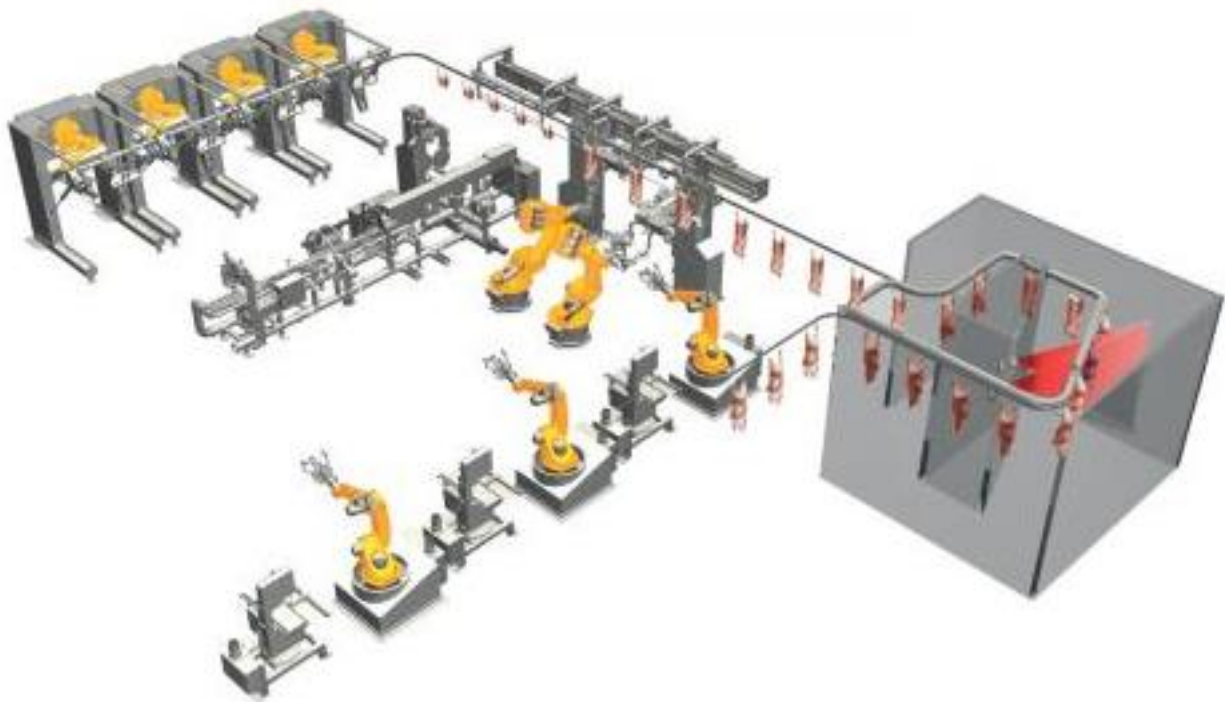
Robotics like this could have very positive effects on food safety. Removing or greatly reducing the human presence from processing means less human error, be it cross-contamination from other parts of the factory or physical contaminants like hair or skin. The health and wellbeing of employees is also something to consider – workers in the meat processing industry often suffer injuries in their physically demanding line of work. A report released in 2016 found that 34 workers at American packinghouse giant Tyson Foods were hospitalised between January – September 2015, with 17 of those requiring amputations[13].

Automation in other areas on-site also improve food safety by removing the likelihood of a hazard going undetected. For example, in July 2015 speciality food producer Atkins & Potts switched from paper-based pest control records to an online system with a remote monitoring rodent unit[14]. This registers when a rodent is trapped and sends an alert in real time, so responses are rapid. Electronic data is also centralised and far less likely to go missing then its paper-based counterpart.

As well as the automation of physical tasks, quality control measures on the production line are also benefitting from emerging technology that guarantees higher detection rates in real time.

Production line systems and food safety

On-the-line monitoring tools are essential for the tracking of critical control points, detecting variables that are either impossible or difficult for humans to. These have long been utilised on typical production lines in the UK to monitor temperature, PH, pressure, humidity and more. However, as the demands for food safety and self-regulation increases, the need for fast sensing technology with instant reporting functionality will inevitably grow.

The existing issue with many monitoring systems is the human intervention needed to document the information, often on paper. Where the Internet of Things has provided game-changing opportunities is in real-time monitoring and alerts, as well as the streamlined effect this will have on collecting data for analysis.

For example, in 2016 Crown Chickens invested in X5 Spacesaver systems by Loma Systems, which detect physical contaminants like metal, glass, bone and plastics[15]. These systems improved detection performance by 25% with a 20% smaller footprint than similar machines, placed at the end of separate lines operating at speeds of up to 40 packs per minute[16]. Additionally, event data from a network of machines like this can be tracked and analysed using reporting software tools. In Loma Systems' case they have released TRACS, which is designed to work with a range of their systems[17]. With the early Regulating Our Future papers placing so much emphasis on self-regulation and compliance with third-party audits, easily-accessible historical data that can be monitored, reported on and analysed in just a few clicks is going to have major appeal to UK manufacturers.
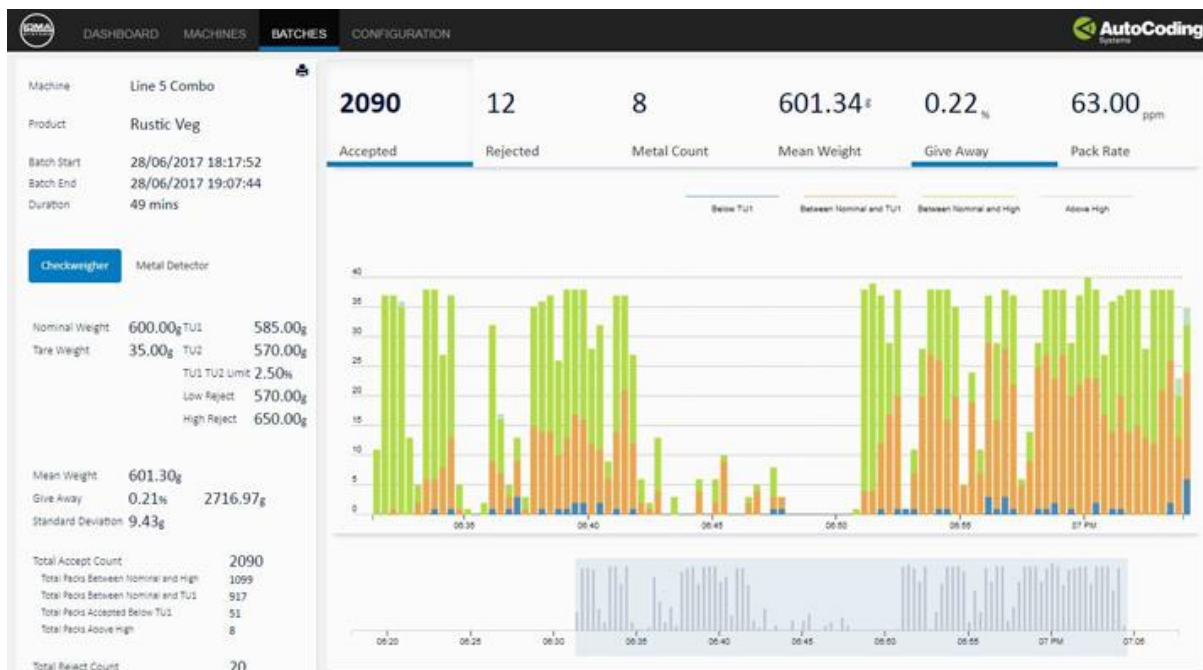
High-tech methods are also being trialled in the UK to directly tackle pathogens linked to food poisoning outbreaks. Examples of these are:

- Rapid Surface Chilling: Cryogenic vapour is used to chill the surface of poultry rapidly without changing the taste, texture or appearance of the poultry. In initial trials by Bernard Matthews and BOC in 2013-2014, the process reduced campylobacter counts in chickens by an average of 90%[18].
- SonoSteam: A combination of steam and ultrasound, again with the aim of reducing campylobacter levels in poultry. Faccenda Foods was the first UK poultry company to invest in trials of this technology in 2014[19]. During trials Sonosteam reduced campylobacter by 80% and it has since been widely adopted by the UK poultry sector. In 2016, the reduction of campylobacter in supermarket chicken samples was partially attributed to Sonosteam technology as an intervention[20].

Improving food safety does not necessarily end on the production line. Smart packaging is a hotly-discussed topic in the food manufacturing landscape at present.

Smart packaging

The value of the smart packaging market globally is forecast to reach $7.6 billion by 2021[21], with some sources suggesting an increase to £40 billion by 2025[22]. Growing concern amongst consumers about food waste, quality and safety is driving investments in smart packaging – be it to extend shelf life, monitor freshness or for quality assurance.

Smart packaging and its purpose can range, depending on what the individual manufacturer sees as adding value to their product. Take thermochromic inks – now fairly established and used en masse. At their most gimmicky, these inks have been used by multiple beer manufacturers on packaging to indicate when your beer is at its 'optimal drinking temperature'. However, its use on high-risk produce like milk and yogurt means consumers are aware once their product has reached a pre-determined 'warm' temperature and consequently helps to address concerns about food safety[23].

Smart packaging is already being combined with data available through the IoT as a response to issues regarding traceability. For example in 2017, producers of virgin olive oil teamed up with technology firm Thinfilm and embedded tiny chips that can be scanned by smartphones and, using an app, can tell the consumer exactly where the oil was grown and bottled[22]. This was developed to fight fraud – in the virgin olive oil sector as much as 70% of oil sold is thought to be fake – but this kind of intelligent packaging could be massively beneficial in preventing food safety outbreaks. If consumers could scan the packaging of a whole chicken to find out the digitally-stored kill date and source code, could

incidents like the recent 2 Sisters Food Group scandal be prevented? Could this information be updated to indicate that the product being scanned has since been recalled or is past its use by date?

The possibilities with this kind of internet-connected packaging are endless, but there are drawbacks that probably need to be addressed first. This kind of technology comes as a cost and with manufacturers under more pressure than ever to reduce these, any smart packaging considered would have to add significant value to even be considered by UK food businesses. Ideas like the iOlive scanning app are 'nice' but the tags needed for the packaging comes out at 12p per unit on average[22]. Additionally, established scan-systems that connect to the cloud, for example QR codes, are now generally ignored on packaging by consumers. Businesses have to ask themselves whether shoppers really care enough for this to make a difference to their purchasing decisions and, therefore, their bottom-line.

Secondly, the different materials needed for this sort of packaging poses a recycling nightmare. Whilst solutions to this are being looked at – for example, keeping electronic chips in sleeves to make it easier to separate for recycling – food businesses looking into smart packaging need to liaise closely with environmental experts to ensure it can be recycled easily.

With all of these machine and internet-based possibilities, it is easy to forget that people are still very much at the centre of the food manufacturing sector in the UK. Without a strong and transparent food safety culture in place, consumers will still be at risk, no matter how much is invested in robotics or intelligent packaging. But technology and the IoT can also play a significant role in the establishment of food safety culture in the training phase, as well as help manufacturers nurture long-term workers into multi-skilled advocates of food safety.

Food safety culture is best accomplished when the workforce is engaged. A solid training programme can set all employees on the path towards a good food safety culture by instilling values in them early in the induction process. Since the scandal that engulfed the 2 Sisters Food Group, the FSA has identified issues with 'aspects of staff training' and consequently expanded its investigation to all 12 factories in the manufacturing giant's poultry operation[24]. The regulator knows all too well that bad attitudes to food safety can take hold throughout a business – even one with sites scattered nationwide - and be hard to shift without a total revamp of the way things are done.

The nature of the manufacturing labour market means training can be difficult to track, especially when it comes to the documenting of individual employees' progress. Whether manufacturers are ready or not, Regulating our Future is coming and self-regulation is shaping up to be a key part of how things will be done. That means training records need to be easily accessible so businesses can quickly demonstrate - be it to the FSA, local authority or third-party private auditors - that they are fulfilling their legal requirements.

Digitalising training, though perhaps daunting to companies using only traditional face-to-face learning, removes a lot of the admin and risk of training records being lost, unordered or not registered at all. Areas of non-compliance can be identified in real-time and meaningful action taken immediately before a laissez-faire attitude to food safety is allowed to set in.
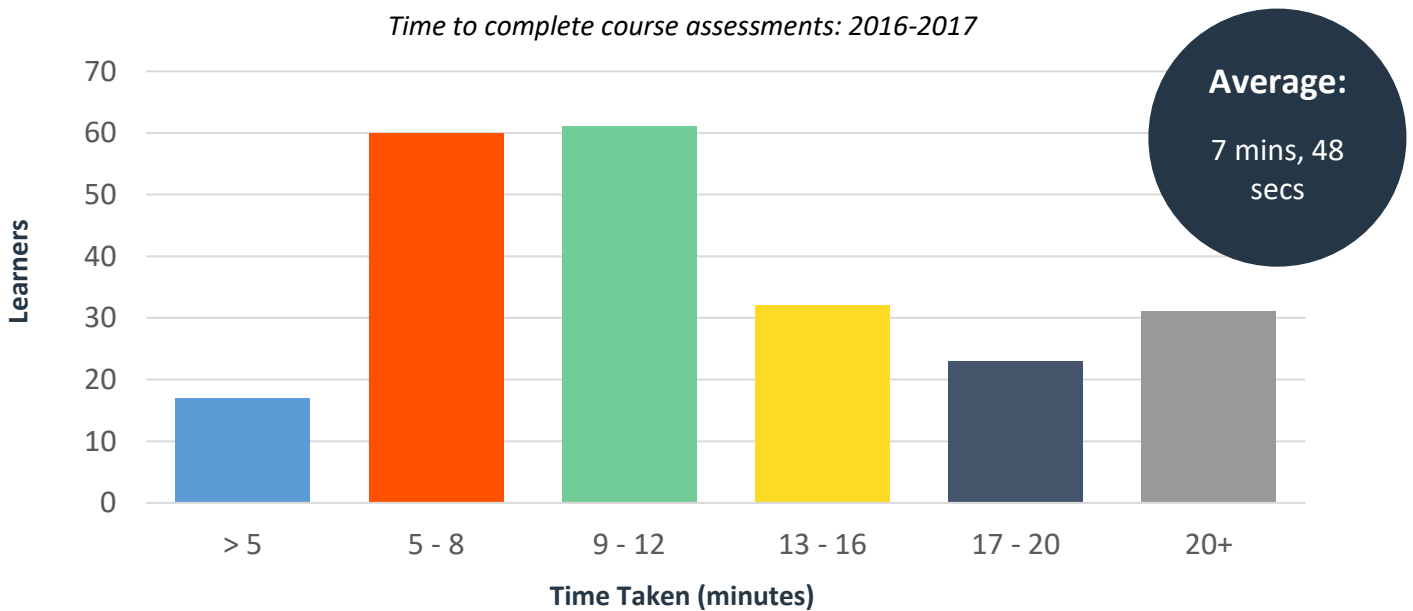
e-Learning

Online training offers a more convenient, recordable and cost-effective alternative to traditional face-to-face training – where employees are often required to go off-site. Industry-wide courses for

compliance such as Level 2 Food Safety & Hygiene can be undertaken at the learners own pace, with a recorded certificate after successful completion of an assessment at the end of the course. These modules can also be accessed on devices like tablets and smartphones, meaning they can be done in the employee's own time at home or during their daily commute.
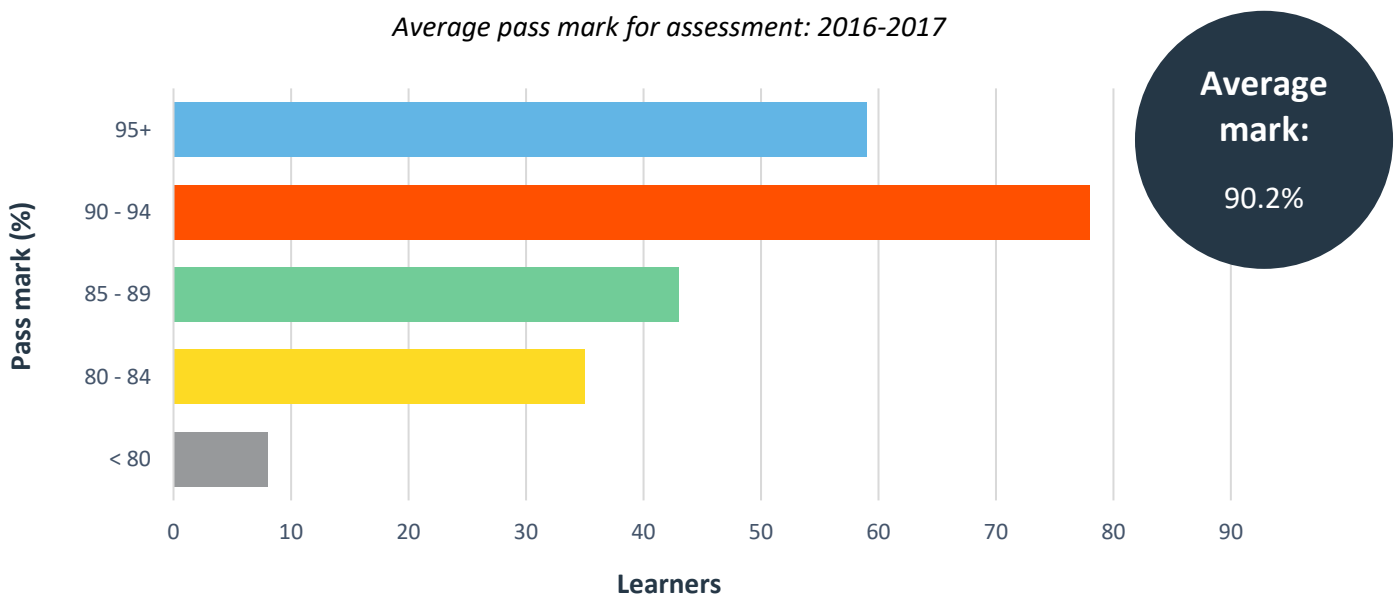
Many forward-thinking food manufacturers have already embraced e-Learning. After years of using classroom style learning, as well as group training on site, one dairy manufacturer made the switch to e-Learning. They found that releasing staff from the shop floor to attend training sessions and having to wait until there were enough employees to fulfil the minimum face to face class size, was causing time and cost issues in their training programme.

Online training has provided the flexibility to get employees trained within a tight timescale and offers a wide range of courses relevant to the food industry.
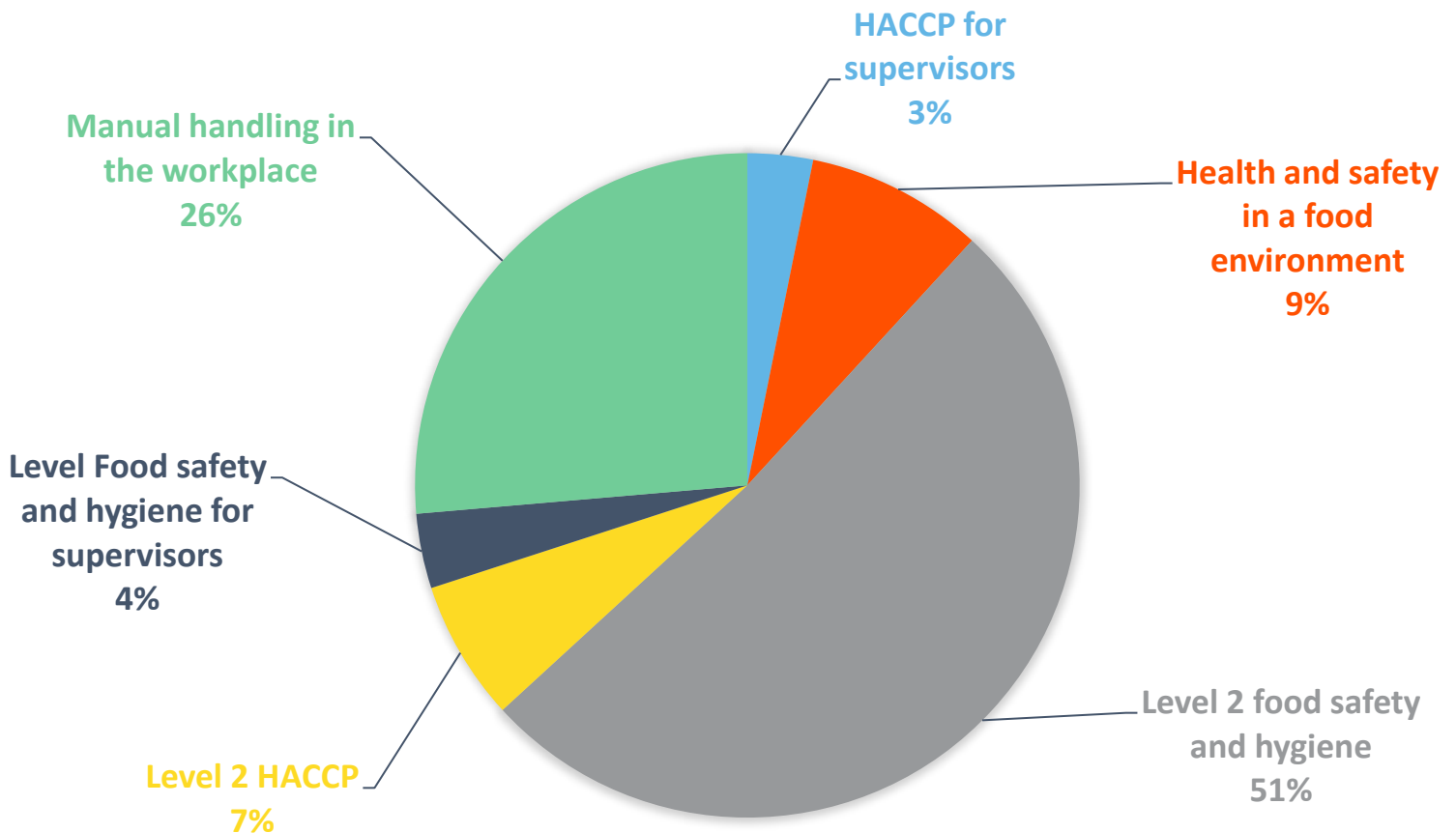

Time to complete course assessments: 2016-2017

Average:

7 mins, 48 secs

Average pass mark for assessment: 2016-2017

Average mark:

90.2%

Training modules taken: 2016-2017

HACCP for supervisors
3%

Manual handling in the workplace
26%

Health and safety in a food environment
9%

Level Food safety and hygiene for supervisors
4%

Level 2 food safety and hygiene
51%

Level 2 HACCP
7%

"Training and development is essential within the food industry to ensure when relevant legislation or regulations change, employees are aware and are trained against the changes made. The training programmes delivered are designed to capture these changes ensuring staff are trained to the highest standards of food safety measures.

Without the training errors are likely to occur, with employees unaware of important rules in place which may result in food safety being compromised." **–Quality Co-Ordinator**
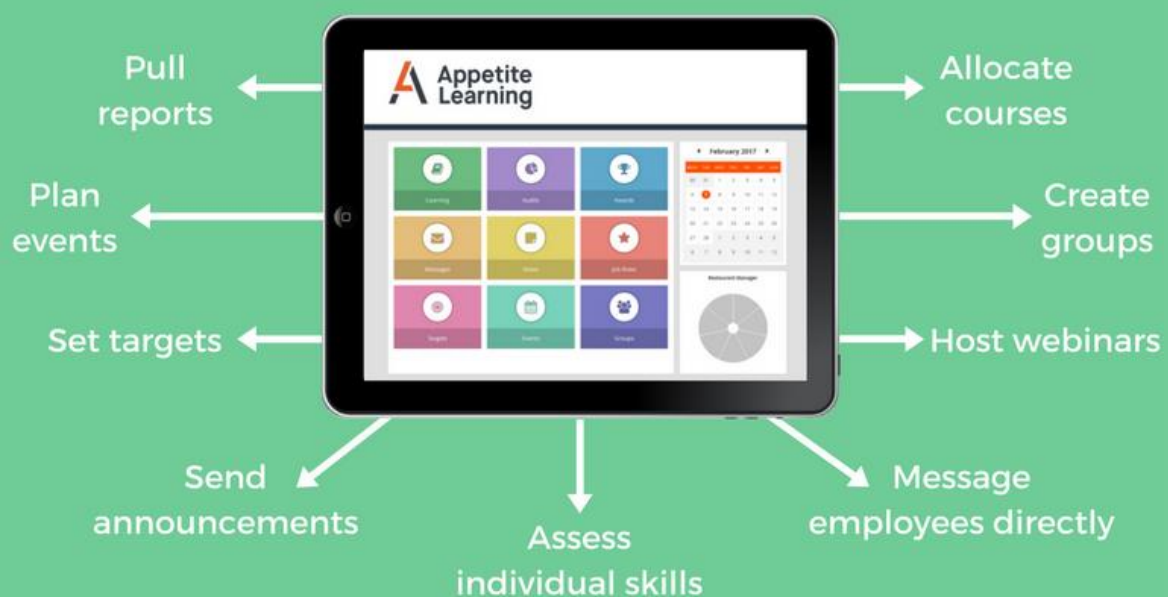
Learning Management Systems

Whilst online training provides critical documentation like certificates, an effective learning management system is integral to the centralisation of this data, which is often spread across multiple sites nationwide or even globally. Additionally, reports can be pulled on these systems in just a few moments, so gaps in employees' food safety training can be quickly identified and corrected.

The key selling point of a learning management system in the wake of Regulating our Future is the ability to store current and historic training data exactly pinpointing employees, what courses they've completed, how many attempts it took to pass the assessment and whether refresher training is required. Manufacturers can quickly demonstrate to auditors that compliance requirements have been fulfilled with exact figures and charts to illustrate this. This level of proactivity is what will make businesses stand out to the FSA and earn recognition as a leader in food safety.

Conclusion

2017 has left UK food manufacturers with a lot to think about. Business need to assess investments in improving food safety with the changes proposed by Regulating our Future at the forefront of their minds. Earned recognition is going to become increasingly important and the FSA will be looking for companies who do food safety well to put on a pedestal.

Investing in technology is one way to achieve this – removing variables like human error on the production line, considering upcoming machinery with superior detection rates and using advanced interventions to reduce pathogens will help tackle food safety at its source. Meanwhile smart packaging and using the internet to store and update product information could help educate consumers and prevent food poisoning at home. Most vitally in the context of the upcoming regulation changes is the possibility the IoT brings about for centralising data digitally, be it for a network of machinery on the factory floor or for the workforce's food hygiene training.

The proposed changes to regulation might be daunting, but these also present a massive opportunity for manufacturing companies to build consumer trust which, given the increased publicity to incidents like the 2 Sisters Food Group scandal, is currently quite volatile. When the UK officially exits the EU in 2019, a reputation for meticulous food safety practices will make companies shine, both in the UK and on the world stage.

About the authors of this paper

A division of William Reed, Appetite Learning offer online training to a multitude of businesses within the food & drink industry.

As the publishers of over 10 brands in the food and drink sector, including Food Manufacture and Food Navigator, William Reed benefits from unique insights into what training problems businesses face. The services and products on offer from Appetite Learning have been tailored to resolve some of the most common issues in the manufacturing industry such as high staff turnover, training costs and more.

Powered by our partners Virtual College and utilising pioneering technology, Appetite Learning offer a wide range of off-the-shelf courses to help quickly demonstrate compliance and fulfil health & safety measures. Additionally, businesses can collaborate with Appetite Learning in the development of bespoke modules that precisely fit the needs and wants of your company.

Appetite Learning's powerful and mobile-optimised Learning Management System can transform your staff training. Company-wide administration, monitoring and reporting can be easily controlled from any location, even if your company has multiple sites globally.

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