Food traceability is a long standing issue that’s really come to the fore in the last couple of years, spurred largely by the horsemeat scandal. As a result of the scandal, the public are becoming much more aware about the food that they’re eating and businesses are having to be much more aware of potential supply chain issues.

Traceability is, perhaps, the biggest challenge facing the food industry over the next few years.

To discuss this challenge and identify potential solutions, we bought together a panel of expert speakers from very different areas of the food industry for a fascinating webinar discussion. What follows is a detailed write-up of the key takeaways to come out of that discussion.

WEBINAR CONTRIBUTORS

DR BIZHAN POURKOMAILIAN
MCDONALD’S EUROPE

Bizhan is a specialist in food safety management systems with extensive experience in developing, implementing, auditing and training the food and beverage sector. He joined McDonald’s Europe in 2000 and is now Food Safety and Supplier Workplace Accountability Director.

RICHARD LEATHERS
CAMPDEN BRI

Richard joined Campden BRI in September 2011, working in the area of Food Manufacturing Technology – HACCP and Quality Management Systems. He started his career in the food industry nearly 30 years ago with Dairy Crest and subsequently worked for both Best Foods and Heinz. He also has experience within the fresh produce sector at Kanes Foods, as well as analysis systems in the milling / baking areas, and is a BRC qualified auditor.

SARAH DANIELS
THE REDCAT PARTNERSHIP LTD

Sarah is a Chartered Environmental Health Practitioner, Trainer and Consultant. She and The RedCat Partnership team advise & train both catering & manufacturing businesses on their Food Safety Management requirements.

DR MARTIN NASH
ELEKTRON TECHNOLOGY

Martin is the product manager for Checkit, Elektron Technology’s wireless food safety monitoring solution. He joined Elektron from Thermo Fisher Scientific and specialises in the application of software, sensors and other instrumentation to solve real-world problems.
Food fraud

Research from the Food Standards Agency suggests that as much as 10% of the food we eat in the UK is actually fraudulent. What’s more, research from the University of Portsmouth shows that this fraud is costing the UK £11 billion per year.

But food fraud is a hugely global issue. One result of the horsemeat scandal was that it showed the general public how long some of our food chains actually are and how many countries a lot of our food has come through.

“The public and businesses are becoming much more aware about the food that they’re eating, the supply chain and issues around food safety.”
Sarah Daniels, The RedCat Partnership

What constitutes food fraud?

• The deliberate substitution, addition, tampering or misrepresentation of food ingredients.

Or...

• False or misleading statements made about a product for economic gain.

It’s important to note that this definition specifically says food fraud must be deliberate. Occasionally we see examples of things being done by mistake, but that’s a separate issue and doesn’t constitute fraud.

The second bullet point also suggests that there’s often a criminal element to food fraud, whereby people are doing it for profit or gain. Honey is one of the most commonly cited offenders and there have been a large number of cases whereby it’s been substituted with cheaper ingredients (such as cane sugar with honeysuckle fragrance and food colouring) and sold as honey. There have also been cases of regular honey being labelled as the rarer (and much pricier) Manuka honey.

The grid below was produced by NSF International and shows the levels of profit that can be made from specific products and the likelihood of detection:
But fraud isn’t limited to these and there are a huge number of products that can be affected. One of the key things this research highlights is the low likelihood of detection. Even after the horsemeat scandal, food fraud remains one of the crimes that’s least likely to be detected.

This makes it particularly appealing to criminal organisations, especially when you consider the lesser punishments when compared to other crimes. Fines for this type of crime tend to be in the thousands of pounds rather than the millions and potential jail sentences are usually months rather than years.

This raises a number of questions:

- Do we know what we’re eating?
- Do we know where it’s come from?
- And is it safe?

The fact that this is such an international problem presents a real challenge for regulators. When food is crossing so many boundaries, it makes it very difficult for regulators to track. We need to bring together intelligence from around the world and get businesses to share information with each other.

Tackling this problem also requires a skill set that isn’t necessarily in the regulator’s forte. Essentially, they need to start thinking like criminals, but for many food fraud wouldn’t have been covered when they did their original qualifications and training, so it’s a steep learning curve.

In our recent webinar, we ran a snapshot survey to look at the role of regulatory bodies and whether they’re doing enough to ensure a robust supply chain. The results weren’t particularly positive, with over half of respondents saying they were doing little or nothing and not a single respondent said they were doing ‘very well’.

### How technology can support traceability

There’s a lot of new technology on the marketplace, but what can it offer and how does this support traceability?

Currently, most businesses stay on top of and deal with the requirements for traceability by using paper-based checks to record key information. In many respects paper provides a very low-cost, affordable means to implement traceability monitoring - but it isn’t without flaws.

Paper-based records can easily be fabricated, lost or illegible and that leaves the potential for it to be an unreliable system even with the best practices in place.

Cloud technology greatly reduces the resources required to manage data and makes the system easily scalable. Therefore, a small business can employ a low-cost technology whilst a larger, more complex business can employ something more advanced that can cover multiple sites.

See: [6 reasons to stop using pen and paper food safety records](#)
On top of that, many food businesses are being increasingly squeezed in terms of budget and resources, so the number of checks that are happening is sparse and doesn’t cover anywhere near the number of food products that we’d like to see. The result is that although we’re trying to be proactive, we’re usually reacting to issues that have already occurred and because we’re so reliant on paper based systems means that it takes much longer to identify problems than it ought to.

These days, there are whole hosts of different technologies available to help food businesses monitor and manage traceability. Unfortunately, many of these technologies have a reputation for being quite complicated or quite expensive to install and this puts a lot of businesses off, but systems such as Checkit are now utilising Cloud computing infrastructure which makes the technology much more affordable. Cloud technology greatly reduces the resources required to manage data and makes the system easily scalable. Therefore, a small business can employ a low-cost technology whilst a larger, more complex business can employ something more advanced that can cover multiple sites.

The diagram above uses the Checkit system as an example of how the system lays out on a single and multi-site basis.

This mixture of fixed and handheld sensors provide a comprehensive solution for monitoring food safety and traceability throughout a business. These sensors coordinate with a local hub which will aggregate the data and transmit it to a central location, which in the case of Checkit will be a Cloud application. It’s possible to monitor easily and quickly in real-time the status of a whole variety of different food safety-related checks at different locations and bring this data together for comparison and analysis.

“For multi-site food businesses or multiple links within a supply chain, food safety technology makes it possible to monitor easily and quickly in real-time the status of a whole variety of different food safety-related checks.”

Martin Nash, Elektron Technology

**Fixed sensors**
The fixed sensors run on lithium batteries that last in excess of a year at a time. They offer a continuous trace, with data being monitored every 5 minutes. You can see exactly what the temperature, humidity and door status of food storage units look like, without there being any gaps in the data. It’s automatic, so there’s also no room for human error or tampering. It makes data far more rigorous.

It’s also possible to employ these sensors in vehicles, so continuous monitoring can still occur when transporting food products from location to location. Systems are then able to pull all of this data together and transfer it to a centralised system for monitoring and reporting purposes.

The other aspect of fixed sensors is the instant alerts they offer.
Typically, with these types of systems and sensors, you can set minimum and maximum limits for the different parameters that you need to measure. As soon as you reach a non-compliance or the temperature drifts outside a set threshold, an instant alert will be sent to a designated person in real-time. Management can be made immediately aware of any problems and, of course, corrective actions can be logged to clear the alarm.

As each user will log in with their own user ID and password then there's full accountability and traceability. If there is a problem, the time and the date that it was recognized and the action that was taken is recorded. It gives that ruggedness and that reliability for fixed location monitoring in and around different parts of a business.

### Handheld sensors

To accompany the fixed sensors, there are also handheld devices that allow us to monitor and capture different types of checks within a food safety system, within a site or even within a supply chain.

Within the Checkit system, it's a multifunctional device that can be used to capture temperature, but it can also be used to capture things like opening and closing checks and hygiene checks. You can even build checklists for deliveries so you can record temperatures, package quality and invoice delivery information. Other items might include stock checks and even things like calibration checks on the device itself. It brings a whole new dimension that you can use for these different varieties of checks and because it's user configurable, you can fit this against your business and build the required checklists that you need to support your monitoring requirements.

Going a step further, many of the systems that are available allow checklists to be scheduled for certain users at certain times of day, making it very easy for a user to log in and complete a checklist that's important to monitor or to manage food safety. The nice thing about wireless handheld devices is that they automatically upload all of the data that's captured with the user stamp and a time and date stamp into a centralised system. So, there is no paper.

It removes the possibility of human error, so it's no longer possible for somebody to forget to complete a check, to lose some paper or to fill it out incorrectly. It ruggedizes that data transfer and ensures that the records are in a centralised location for reporting and real time monitoring. Modern handheld devices, such as the Checkit system, will also prescribe corrective actions as well, making it easier and more straightforward for the user to decide what they might need to do in the event of a non-compliance.

### Real-time visibility

The data is collated by local hub, which displays the information locally so that workers in and around the site can see the status in real time. But the data is also transmitted to the Cloud for managers and other staff within the business to monitor.

From any location in the world, managers can monitor a specific site, tens of other sites or an entire chain of sites, to verify that the correct information and the correct checks are being done and are in place.

It means issues can be managed in real-time. You're immediately aware of problems, so rather than identifying problems and taking corrective action long after the initial event has occurred, we can start to be more proactive and deal with problems before they become a food safety issue.

The bigger challenge is applying this across multiple companies throughout a supply chain. It requires collaboration between customers, suppliers, auditors and other legislative bodies to gain a consensus about realistic goals.

Collaboration on this scale would require a significant cultural shift. Data sensitivity is an issue and some companies may not want their data to be shared, but it would be possible to make data only accessible at certain points.

Cloud computing looks set to play an increasingly important role in food safety. It enables businesses to reduce costs and makes food safety easier to monitor and manage. We can also expect sensors to move beyond temperature and look at areas such as chemical tests or DNA tests, which will go a long way to ensuring a reliable supply chain.
Supply chain management of food safety at McDonald's

Across Europe, there are a only a small number of key things that McDonald’s consider it needs in the supply chain in order to be able to manage it appropriately and, specifically, to ensure the safety of the food throughout the whole supply chain.

It helps to have one strategy which will completely cover all of the supply chain, and it’s important to remember that the links between the different stages of the supply chain are just as important as the building blocks of the stages in a supply chain.

“It's very, very important to have the relationships in place so that you can cooperate with suppliers and work together to ensure you have safe food and traceability through the whole supply chain.” Bizhan Pourkomailian, McDonald’s Europe

The strategy is outlined in the company’s food safety manual, which covers farm to the counter and all the steps in between. Within the document, there are all the working specifications, policies and guidelines, which can change as the company improves or learns from others on how to make the system more robust.

**Beef supply chain**

For McDonald’s beef, there are five steps in the supply chain.

1. **Farm / Field**
2. **1st Processor**
3. **2nd Processor**
4. **Logistics**
5. **Restaurant**

In the first place we have the farm, then we have the primary processors which is the slaughter and deboning site, followed by the patty forming at the second processor site where the actual hamburger is made, then we have logistics and distribution before it arrives finally at the restaurant.

We can also see (below) the System Management Standards that are in place, which are essentially the building blocks for each one of the stages. As well as the legal requirements, there are also a number of standards that are checked which go far beyond the legal requirements.

For example, at the farm, which is the first part of the chain, traceability, animal health, welfare and Good Agricultural Practices (GAP) are legal requirements. But on top of that there is also STEC Control (Shiga-toxin producing E. coli control), feed control and HACCP (Hazard Analysis and Critical Control Point programs).

Every other section has different requirements and different building blocks to make sure that that segment is managed thoroughly and properly.
Those are the System Management Standards that exist within each of the blocks, but there are also compliance measurement standards and verification processes which are needed to make sure that the system standards are actually being fulfilled.

There is the ‘McDonald’s Agricultural Assurance programme’, which includes Good Agriculture Practices (GAP) as well as some requirements that are quite specific to McDonald’s. These include a test or verification process to make sure all of the System Management Standards are being adhered to and there are independent audits conducted at the slaughter and deboning plants on traceability and food safety to make sure all the processes are in place.

In turn, this is followed through with Supply Quality Management Standards (SQMS). This is an internal standard, but it was created by taking ISO 22000, ISO 9001 and ISO 1202-1, which is the actual good management practices standard, and putting them together. SQMS is carried out by third party auditing firms on the processing sites.

Likewise, the Distribution Quality Management Program is also comprised of best practices and made into an audit standard which is independently used to get all of the distribution centres audited.
Inside the restaurants there are three different kinds of testing:

- One is internal, which is Restaurant Operations Improvement Programme (ROIP). It's done internally by operational staff.
- There's an audit which is done externally done by third party companies.
- And there is microbiological sampling done at restaurants.

It’s worth noting that the microbiological sampling is not pathogen testing. It's done to see how the hygiene is and to ensure that training is appropriate for cleaning and maintaining hygiene standards.

But despite having all of these standards and processes in place, Bizhan is keen to emphasise that McDonald's can’t rest on its laurels. There are still a number of challenges they face. For one thing, about 70% of its restaurants are franchised and whilst they work closely with logistics, processors and farms, they don’t own any of these. For that reason, they rely closely on information from other areas, such as Food Safety Advisory Councils and the European Food Safety Authority, and there are risk assessments conducted by Councils, independent industry expert groups such as The Global Food Safety Initiative (GFSI) and research institutes like Campden BRI. All of this in addition to what the company is already doing internally ensures they get the right information to make sure that the food safety systems in place are the right ones and that there’s a right way of verifying them.

**Fraud and traceability**

It’s always been difficult to maintain good documentation to ensure traceability. You need to have a system that can handle this information and you need to make sure you have the right resources to be able to keep this data up-to-date.

The challenge is that if you take a single ingredient at restaurant level and try to trace it all the way back, there are often numerous steps in the chain and it can take time. By the time you document it, it’s already too old. You need to have real information in real time.

McDonald's have found that the easiest way for them is through the relationships at each stage of the supply chain. If you deal with a secondary processor, then they will be able to pick up the phone and contact the primary processor to get the information you need. This can be followed all the way down the chain.

Bizhan and his team at McDonald's have tested this and found that for any ingredient, if the source is in the same country or time zone, then you can have accurate information within three hours.

When looking at global supply chains it inevitably takes longer. For example, when the situation with melamine emerged a few years ago, it would have taken longer to find out whether the raw material was from China or not due to the different time zones involved. Despite this, with the right relationships in place it was still possible to have an answer within 24-hours simply by contacting your supplier, asking whether a specific ingredient from a specific batch came from China and following this process right the way through the chain.

It’s really important to have these relationship built between each stage of the supply chain, and this is one of McDonald's ethos’ – to have the partnership, the trust and the transparency between suppliers.

It’s vital to work together so that you have safe food that's traceable through the whole chain, enabling you to act quickly if and when an issue arises.
If something does happen at the farm then it can affect the restaurant and everybody else in between. In fact, in a snap survey we ran during our recent webinar we asked users “to what extent are business reputational needs integral to combatting food fraud?” A staggering 87% said it was ‘very’ or ‘absolutely’ integral.

The future of food traceability

Wouldn’t it have been much simpler if, in 2013, all the horses had barcodes? As it happens, in Northern Ireland there were 70,000 unaccounted for horses that year, and we can only speculate as to where they ended up.

As a result of the Horsegate incident, there’s been a revision to the BRC standard with regards to one of its clauses on traceability to say that sites shall test the traceability across the entire range of products for, amongst other things, mass balance. In the event that a questionnaire was used for verification, then a mass balance would have to be done to prove that it’s effective.

In terms ISO 22000, then the latest clauses (which we can expect to come in to place in the near future) say that the system should be able to identify incoming raw material from immediate suppliers and the distribution routes.

BRC also goes on to state that within the supply chain a vulnerability assessment needs to be carried out on all raw materials. There are some key things that need to be taken into account, such as the historical evidence of substitution or adulteration which alludes to the elements of food fraud we’ve already discussed. There are also the economic factors, so if there’s a shortage of a raw material or indeed, if there’s left over raw material, then potentially, there’s some opportunity for fraud and for traceability to be compromised.

Anyone who was at the eye of the storm of the Horsegate incident will likely have been flabbergasted at just how complex their supply chain was. There was one organisation that thought it had 50 process handling steps, but once they started to analyse it they discovered they actually had 450 steps within that one material. That provides ease of access to the raw materials throughout the supply chain.

In this sense Richard Leathers, from Campden BRI, believes the horse meat scandal has actually done the industry good:

“We have to challenge ourselves. We have to challenge the supply chain. It’s really vital to us that we don’t have the level of complacency that, potentially, we had before Horsegate. Although we didn’t like it at the time, I think Horsegate was great in that it has woken a lot of people up and made us react.”
In his report into the integrity and assurance of food supply networks, Chris Elliott highlighted laboratory backup as one of his eight pillars. Routine testing to identify adulterants should ideally be in place, but if a test costs £1,000 then is it viable? Potentially not.

We also need to consider the nature of that raw material. For instance, is it a product like olive oil, where we know that there is more consumed every year than is actually grown? The same is also true of Basmati rice, and given the nature of those raw materials traceability becomes inherently tricky.

There are a number of types of food fraud, the first of which is unapproved enhancements. Melamine is one such example as it was used to enhance protein value, but there are plenty of others. For instance, Sudan dyes in spices, copies of popular foods, dilution, watering down products and substitution. Poultry can also be injected with hormones to conceal diseases and food colouring can be applied. Another source of food fraud is mislabelling or changing expiry dates.

One things that’s of particular concern is where a provenance is declared. It would be very easy to substitute Madagascan vanilla with another type of vanilla, or the use of potentially mislabelled recycled cooking oil.

To tackle these issues, there are a number of guidelines that are available. Guideline 60 from Campden BRI talks about traceability in the food chain, and there are fantastic steps that have been taken with BRC version 7, which has got some great new clauses to look at traceability and food fraud and vulnerability.

In terms of BRC, there’s also the agents and brokers standards that have been released and helps to detail and some of the pairs of hands that the products go through. Part of the earlier review mentioned operation offset, which in just one month in 2014 saw 96 prosecutions and huge amounts of tonnage of products that had been traced and were not of the nature of substance and quality that they should have done.

One of the important things to point out though is that BRC auditors and usual food chain auditors are not forensic auditors. They’re not like the police and aren’t used to doing these types of audit, but it’s reassuring that there is going to be a prosecution on the horsemeat incident and somebody is potentially going to go to prison as a result of some of the adulteration and recordkeeping that happened.

We do have to look at the powers of prosecution that the authorities have. At the moment, they’ve been prosecuting under the new legislation 178, which looks at the nature of the substance and quality and also traceability. But we have to battle against three factors. We have to battle against ignorance, complacency but also criminality, and they’re three distinct threats to the U.K. food industry and also the global food industry.
Conclusion

Managing food safety across the global supply chain is one of the biggest challenges facing the industry.

A number of high-profile cases, some of which have been discussed in this white paper, have put the issue firmly in the public eye and the industry and its regulatory agencies are having to respond to ensure that products can be traced throughout the supply chain. We need to say categorically what is in a product, where it has come from and whether it’s safe to consume.

For this to happen, we need to make use of the new technologies available to us, increase visibility and co-operation between businesses throughout the supply chain and enforce tougher regulations globally.

Technology can offer a much more robust solution than traditional pen and paper based checks. Firstly, it limits the opportunity for fraud as food safety records can be automated and, therefore, can no longer be fabricated (or subject to human error). It also means food safety issues can be flagged and corrected in real-time, rather than retrospectively long after the original problem occurred. Finally, it greatly increases visibility. With the use of Cloud technology, a food safety manager would be able to monitor the status of multiple sites (whether that’s factories, restaurants, shops or even transportation) from any location in the world.

The challenge that remains is in getting multiple businesses to share this information with each other throughout the supply chain, but if we can break down these barriers we’ll be left with a truly transparent supply chain.

There also seems to be a feeling within the industry that regulatory bodies could be doing more to ensure a robust supply chain. There have been some advances in terms of ISO 22000, for example, but when food is crossing so many boundaries it remains very difficult for regulators to track.

Finally, the feeling from our webinar contributors was that a tougher approach is needed to tackle to criminal side of food fraud. The fact that punishments for food fraud are lesser when compared to other types of organised crime and the chances of detection remain low, means it will remain appealing to criminal organisations and they will continue to try to profit from it.

Food businesses need to be more aware than ever about where their products have come from and there needs to be stringent measures in place at every step of the supply chain to ensure the safety of that food.