



Food Supply Chain Vulnerability: A Ti whitepaper in partnership with RQA Group

Vulnerability of the food supply chain is one of the hottest topics in the international food industry. Those vulnerabilities are not limited to breaches of physical security, theft and malicious contamination by ideologues, extortionists, criminals or terrorists. In this whitepaper, Ti's CEO, Professor John Manners-Bell, and Managing Director, RQA Group, Vince Shiers Ph.D., offer insight into the vulnerability of the food supply chain by highlighting the threats and offering analysis of the best practice for securing the supply chain.



Introduction

Vulnerability of the food supply chain is one of the hottest topics in the international food industry. Those vulnerabilities are not limited to breaches of physical security, theft and malicious contamination by ideologues, extortionists, criminals or terrorists. Threats also come in the guise of food fraud: the intentional adulteration of food for financial gain. Examples of the latter can affect large segments of the food industry e.g. Sudan dye contamination of chilli powder (dating back to before 2003, with the latest cases in August 2016), cumin spice contaminated by peanut (2015), and the horsemeat contamination of beef (2013).

Increasing levels of out-sourcing have also exacerbated the risks to the supply chain. 'Economic owners' (the main brand coordinating the supply chain) often have little visibility of the conditions in which the products are manufactured, transported or stored.

In order to enhance the resilience of the supply chains of which they are a part, suppliers, including third party logistics providers, have an opportunity to support their customers through a variety of risk-mitigating services. For logistics providers this could range from developing innovative new sensor technologies which ensure perishable products remain at the right temperature to providing a holistic strategy to deal with critical product recalls. This whitepaper outlines many of the issues involved in food supply chain vulnerability and indicates the major opportunities for suppliers and service providers.



Threats to the Food Supply Chain

Food fraud and Contamination

Vulnerability in food supply chains is not a new phenomenon; the origins of food fraud and contamination can be traced back many centuries. In fact, the Romans recognised that the illegal adulteration of olive oil, a ubiquitous part of the Roman diet, was a real risk to their food supply chain and decreed that each olive oil container should be labelled with information such as producer, point of origin, importer, weight and quality, then sealed to prevent fraud. Today, traceability and food defence systems are certainly more sophisticated but it could be argued that unless they are effective, they are not much further advanced. Perhaps that is why food fraud is still a widespread issue.

Many food manufacturers are now looking to improve the effectiveness of their traceability by examining the practices of their suppliers' suppliers and tracking products during transportation as a way of strengthening their food defence systems and reducing their supply chain vulnerability.

So where do these threats originate in the food supply chain? Almost all food products start with primary ingredients (crops, meat, flavourings etc.). Even at the start of the supply chain, high value crops are exposed to threat. For example, post harvesting of vines may be exposed to the risk of deliberate mislabelling of inferior grapes with superior varieties. Food fraud occurs where consumers (and producers down the supply chain) are misled into paying a premium for an inferior product. Substitution early in the supply chain has been seen with the replacement of Arabica coffee beans with the cheaper Robusta variety. The potential for criminal activity is often a result of a price gap on the commodity market between a premium and a lower quality variety and the criminals' reliance on the inability of the consumer to discern the difference.

Contamination for fraud purposes is most common at the first stages of the supply chain and the early stages of ingredient preparation. The issue becomes most extensive if an ingredient is tampered with early in the supply chain but the contamination is only detected once finished products are with consumers. This was the case with some of the largest and most widespread product recalls in recent years. Examples include:

- Peanut in cumin

The worst case scenario is a contamination of a minor ingredient at an early point in the supply chain that results in a danger to consumers. This was the case for the recalls of products containing cumin in the US between late 2014 and 2016. Cumin imported from Turkey was used in a wide range of products including seasoning mixes, soups, prepared chicken dishes, meatloaf, satay, ethnic sauces and many others.

Whilst the level of peanut contaminant was very low, the risk to allergenic consumers was considered too great and over 250 products were recalled. The cumin itself probably did not originate from Turkey but due to poor traceability and incomplete knowledge of the supply chain the exact origins of the contamination are still to be confirmed. It is believed that the contamination was probably caused by intentionally adulterating cumin with cheaper crushed peanut shells but contamination may also be the result of cross contamination in storage, distribution or at primary manufacturing stages.

- Sudan Dye

Chilli powder was fraudulently contaminated with the industrial dye (and carcinogen) Sudan Red in India, the intense red colour attracting a higher market price. Unfortunately, the chilli went through an extensive supply chain being used as a minor ingredient in ready meals, pizzas, and Worcester sauce; the latter which is also an ingredient in more food products. When the contamination was detected by the Italian food authorities in 2003, it was already too late and the resulting recalls across Europe cost tens of millions of pounds as well substantial reputational damage to the food industry. Although it was generally accepted that there was no health risk to consumers due to the extremely low level of contamination in the final product, it did not stop headlines such as, “Cancer ready meals”

- Horse meat

In January 2013 it was revealed by the Irish Food Standards Agency that horse meat had been found in the products of an Irish supplier to UK manufacturers and retailers. It rapidly transpired that the problem was Europe-wide, and for the first time the public became aware of the complex networks evident in food supply chains.

Well-known food brand Findus was implicated in the scandal when horse DNA was found in some of its products. Findus had placed an order for a range of mince-based products such as lasagna and moussaka with a Luxembourg-based French supplier called Comigel (the company also manufactured Tesco, Aldi, Lidl, and Carrefour’s own-label frozen meat products). This company in turn had sub-contracted the sourcing of mince to another French company Spanghero who via a number of other channels substituted horse meat for beef, supplied by a Romanian abattoir, and subsequently mislabelled the product. French authorities investigating said that Spanghero could have made around €550,000 by this process.



It is not just the order and financial trail which is complex – the movement of physical goods also can involve extensive cross-border transits. Whilst in its simplest form product should move between farmer-abattoir-processing plant-retailer, in certain parts of the sector movements of product can be international – even intercontinental – in nature. Low cost transport, which has had such an impact in revolutionizing production and distribution in other sectors, has also had a major influence on the food sector.



Parts of the processed food market are more at risk than others. For instance there is far less chance of adulteration in the 'chilled' product section than 'frozen'. Chilled meat products (which command a premium) are usually sourced far closer to the processing plant. The UK's ABP Foods, for example, buys meat from cattle within a 30-mile radius of their factories and the supply chain is very simple. Frozen meat products (such as burgers) are much cheaper and having a lifespan of up to two years have highly complex supply chains more characteristic of the example above.

The extent of the problem was breath-taking. It was estimated that 750 tons of horsemeat illegally entered the food supply chain in Europe adulterating 4.5 million meals. Tests across Europe found that nearly 5% of products assessed contained over 1% horse DNA. In one case, Tesco's own brand burger contained more than 29% horse meat.

Not only is there an issue with mislabelling. Tests found that some carcasses contained a drug commonly used in the treatment of horses - phenylbutazone. Although levels of the drug were so small in any processed meal so not to be harmful to human health, this obviously impacted on consumer confidence further. Despite this, the issue is not specifically one related to health. It is one primarily of consumer confidence and the principle that a label should accurately reflect the contents of the product. Without this confidence, trust in the whole supply chain falls apart.

Other forms of threat

Beyond the farm gates, the supply chain is made up of a series of alternating steps involving transportation, storage and processing up to the point of sale to the consumer at retail. At each stage there is a risk of tampering, theft, substitution or diversion. The more steps in the supply chain can result in an increased risk to the product's authenticity and safety.

Whilst food fraud is more common and has a wider impact when executed early in the supply chain, the entire chain is potentially exposed to risk although the nature of risks may vary. For example, as the product continues its journey through the supply chain, it gains value and therefore it becomes more exposed to the risk of theft and the prevalence of malicious tampering increases.

- Malicious tampering

The malicious tampering of products is more common in food producers and even at the retail stage possibly because the perpetrator can see a direct link with their actions and the result on specific consumer groups or companies.

For example, one of the most serious and highly publicised malicious tampering cases occurred in the US in the 1990s involving the contamination of branded Tylenol headache capsules with cyanide. It is believed that the tampering occurred at the retail level and the result was several deaths. Other cases of retail tampering have involved the retailer Pick 'n Pay in South Africa in 2003 when an attempt was made to extort money after someone claimed to have tampered with products on supermarket shelves and contaminated them with poison. Following a product recall, it was concluded that no products had actually been contaminated and the cases was essentially a hoax.

In the UK in 2009, a factory worker was accused of spreading peanuts around a nut-free factory apparently because of being taken through disciplinary process. The malicious tampering action was carried out due to a grudge against the company itself. This sort of



action, caused by a company's own employees is a certain risk, but also one that should be controlled and mitigated by effective HR procedures and a positive company culture.

- Theft

The risk of theft of products increases as the products gain value along the supply chain. For example, the risk of theft of bulk rye or barley is low, but the risk of theft of whisky is high. This risk is compiled of the value of the product in question, how easy it is to transport, opportunity and prevention and detection measures.

- Food safety and temperature control

When assessing the supply chain vulnerabilities, it is also important to consider the impact of extreme temperatures on products and ingredients. For some products this is not important, but for others, e.g. meat, dairy, ready meals, it is essential to maintain chilled or frozen supply. This must be maintained during processing, manufacture, storage and distribution. Breach of this cold chain can result in quality impaired product or even food safety incident. These factors must therefore be included in the risk assessment of supply chains. It is also not good enough to have complete temperature control, but it is essential to be able to *demonstrate* it throughout the product's journey through the supply chain to the retailer.



Securing the Supply Chain: Best Practice

In order to carry out an analysis of vulnerabilities and risks in the supply chain, it is necessary for a food manufacturer to fully understand all the parties involved in producing, storing and distributing their food ingredients. This is not always as simple as it sounds. A key risk is where a supplier outsources the manufacture of an ingredient to a third party, unknown to the food producer. This third party may not have the expected standard of food safety management systems or proper controls in place to prevent food fraud, adulteration and tampering.

Part of the supply chain vulnerability mapping is therefore to collate information from internationally recognised certifications, supplier questionnaires, and where necessary on-site audits from staff or representatives of the food manufacturer. This applies to all parties including food processors, distributors and warehouse operations. Effective procurement and robust supplier approval and supplier management then become core elements to minimising supply chain risks.

A first step is to consider the exposure of each ingredient to the threats identified in this paper and then rank the risks inherent within the supply chain stages and at each geographical location. For example, if saffron is used as an ingredient, there is high risk of fraud and adulteration with other cheaper spices and dyes. If it is known that one stage of the supply chain involves transportation through war zones or areas of organised criminal activity, the risk level of theft and adulteration for monetary gain can be assessed as high and steps taken accordingly.



Conclusion

The unbundling and out-sourcing of production processes as well as the transportation and storage of products to third party logistics providers has increased the level of risk in the supply chain for food manufacturers. Consequently it has created the necessity for manufacturers and retailers to engage and invest in supplier relationships to ensure that controls, checks and balances are in place at every stage of the extended value chain.

This represents a considerable responsibility for third party suppliers, including those providing global supply chain and logistics services.

As governments and consumers become far more aware of the origins of the food products they buy and the conditions in which they are moved and stored, the issues of food defence and supply chain vulnerability will become ever more critical.

Questions which food manufacturers and supply chain companies must be able to answer include:

- What food defence processes are in place and are they sufficient?
- Where are the supply chain vulnerabilities?
- What are the plans in the event of a product recall?
- Are there robust reverse logistics capabilities?
- What impact would food fraud or tampering have on customer trust and brand equity?



About the authors

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Prof John Manners-Bell is Chief Executive of Ti, Honorary Visiting Professor at the London Metropolitan University's Guildhall Faculty of Business and Law and an adviser to the World Economic Forum. He has over 25 years' experience working in and analysing the global logistics sector. John started his working life as an operations manager of a logistics company based in the UK. Prior to establishing Ti in 2002, he worked as an analyst in consultancies specialising in international trade, transport and logistics. He also spent a number of years as a manager of UPS, in a strategic marketing and communications role. John holds an MSc in Transport Planning and Management from University of Westminster and is an Associate of King's College London where he studied Classics and Theology. He is a Fellow of the UK Chartered Institute of Logistics and Transport and former Chair of the Supply Chain and Logistics Global Advisory Council of the World Economic Forum. He has also advised the European Commission Directorate-General for Energy and Transport. He has written three books on the industry – 'Global Logistics Strategies: Delivering the Goods', 'Supply Chain Risk: Understanding Emerging Threats to Global Supply Chains' and 'Logistics and Supply Chains in Emerging Markets'. His second book, 'Supply Chain Risk' won the Mention Speciale ACA-Bruel Prize for supply chain literature in 2014.

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As Managing Director of the RQA Group, Vince Shiers has responsibility for the RQA business in EMEA and Asia Pacific. He has spent over 20 years providing expert consultancy and training services to the food and consumer products industry. He regularly advises companies on supply chain risk, business continuity and product recall; has been an invited speaker on crisis management at meetings around Europe; and has acted as an expert witness on product recall at the International Court of Arbitration of the International Chamber of Commerce. Vince has also been involved in setting up consultancy service programmes for global product recall and product liability insurers.

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