Food Fraud Vulnerability Assessment and Mitigation

Are you doing enough to prevent food fraud?
Food safety and quality management systems have traditionally focused on preventing unintentional contamination with known pathogens or substances.

Food fraud prevention requires a different approach: it must take into account economic incentives and deceptive criminal behaviour.
Are you doing enough to prevent food fraud?

Food fraud is simply defined as intentional deception using food for economic gain.¹

GFSI compliance will soon require a food fraud vulnerability assessment and food fraud mitigation plan.

Recent food fraud scandals from around the world have highlighted the need to strengthen food fraud prevention measures across the entire supply chain. Not only is this necessary to protect the health of consumers, but corporations and regulators both know that trust is the foundation upon which efficient, functioning markets are built.

Current food safety and quality management systems, however, were not originally designed to prevent fraud.² Food fraud prevention requires a different approach: it must take into account economic incentives and deceptive criminal behaviour.

Recognising this, the Global Food Safety Initiative (GFSI) will soon require companies to conduct a food fraud vulnerability assessment and to prepare a food fraud mitigation plan.³

Consumer safety is the most important objective of food fraud prevention, but there is also a financial impact. Food fraud costs the global food industry an estimated US$30 to 40 billion each year⁴. A single incident can permanently destroy a valuable brand, cause long-term industry-wide losses, close off export markets and damage trust in public institutions.

PwC has the expertise in risk assessment, supplier management and internal controls required to help companies assess their vulnerability to food fraud, then design and implement measures to mitigate food fraud risk.

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¹ Michigan State University Food Fraud Reference Sheet
² SSAFE Food Fraud Vulnerability Assessment Tool, 16 Dec 2015
³ New requirements for a documented food fraud vulnerability assessment and a food fraud mitigation plan will be included in the GFSI Guidance Document Version 7, to be released in 2016.
⁴ Professor John Spink, Director of the Food Fraud Initiative Michigan State University
Food fraud is intentional deception using food for economic gain, and generally falls under at least one of the following categories: 5

<table>
<thead>
<tr>
<th>Seven types of food fraud</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dilution</td>
</tr>
<tr>
<td>Mixing a liquid of high value with a liquid of lower value.</td>
</tr>
<tr>
<td>Substitution</td>
</tr>
<tr>
<td>Replacing an ingredient, or part of the product, of high value with another ingredient, or part of the product, of lower value.</td>
</tr>
<tr>
<td>Concealment</td>
</tr>
<tr>
<td>Hiding the low quality of food ingredients or product.</td>
</tr>
<tr>
<td>Mislabelling</td>
</tr>
<tr>
<td>Placing false claims on packaging for economic gain.</td>
</tr>
<tr>
<td>Unapproved enhancements</td>
</tr>
<tr>
<td>Adding unknown and undeclared materials to food products to enhance the quality attributes.</td>
</tr>
<tr>
<td>Counterfeiting</td>
</tr>
<tr>
<td>Copying the brand name, packaging concept, recipe, processing method etc. of food products for economic gain.</td>
</tr>
<tr>
<td>Grey market production/theft/diversion</td>
</tr>
<tr>
<td>Sale of stolen or excess unreported product.</td>
</tr>
</tbody>
</table>

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5. SSafe Food Fraud Vulnerability Assessment Tool, 16 Dec 2015
A different approach is required to prevent intentional adulteration that is specifically devised to evade detection.

Acts of food fraud create a vulnerability that dangerous adulterant-substances have been added or that the product has been mishandled and become dangerous. 6

Food safety management systems generally focus on the unintentional contamination of food by known ingredients, pathogens, mishandling, or processing. Food fraud, however, is an intentional act perpetrated for economic gain.

The criminal’s fraudulent ingredients and/or modifications are specifically engineered to evade the purchaser’s quality assurance and quality control systems.

Only the criminal knows which adulterant-substance has been added, or which food ingredient has been manipulated and how. 7

Moreover, the adulterants introduced by food fraud are often unconventional substances that are not anticipated by food safety management systems, and only become known after they are well into the supply chain. 8

Unfortunately, criminals usually lack the motivation and expertise to determine whether or not their actions will result in hygienic or toxicological risks to eventual consumers.

While the vast majority of reported food fraud cases do not result in a threat to human health, acts of food fraud create a vulnerability that dangerous adulterant-substances have been added or that the product has been mishandled and become dangerous. 9

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7. Moore, Spink, Lipp; Development and Application of a Database of Food Ingredient Fraud and Economically Motivated Adulteration from 1980 to 2010, Journal of Food Science Vol 77 Nr 4, 2012
Fraud is economically-motivated criminal activity, so we must understand criminal behaviour and decision-making in order to assess and mitigate the risks of food fraud. In contemporary criminology, economically motivated crimes result from the combination of opportunities, motivations and inadequate control measures. By analysing these three aspects, we can estimate the food fraud vulnerability for any food product or ingredient.

Figure 1: Food fraud vulnerability assessment framework

“A food fraud generally occurs where the potential for and the temptation of food fraud are high and the risk of getting caught and sanctions are low.”

11. SSAFE Food Fraud Vulnerability Assessment Tool (Annex II), 16 Dec 2015
Opportunity

For any given food product or ingredient, the nature of its composition, qualities, production process, and supply chain, as well as its geographic origins determine the opportunity for fraud. For example, food fraud is generally easier for liquids than solids, and complex foods with multiple ingredients generally offer greater fraud opportunity than simple, single-ingredient foods.

Longer supply chains result in higher food fraud risk. Every time there is a transaction involving food, the buyer depends on the seller to present truthful information about the product. In the words of Professor Chris Elliot, “Every time you have a transaction, there’s another opportunity to cheat.”

This applies to globally traded bulk food commodities as well as primary agricultural products that make their way from small household farms to nearby urban consumers via layers of wholesalers, distributors and retailers.

Specific factors can include:

- Physical characteristics and composition
- Availability of adulteration technology/knowledge
- Technical simplicity or complexity of adulteration
- Accessibility to processing lines
- Complexity and transparency of the supply chain
- Detectability of fraud

**figure 2: Physical qualities and the composition of food products or ingredients are determinants of the fraud opportunity.**

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12. Wageningen University & Research
14. Wageningen University & Research
15. Wageningen University & Research
Motivation

Basic economic motivation can take two different forms: revenue maximisation or cost minimisation. The market conditions for each food product and ingredient determine the level of economic motivation to commit fraud. The more competitive the market, the more incentive there is to use lower cost ingredients as substitutes. High priced food items or items for which subtle characteristics account for significant price differences can present lucrative opportunities for fraudsters. In the words of Andy Morling of the UK Food Standards Agency’s National Food Crime Unit, “Where there is money, there is crime; where there is big money, there’s big crime.”

Motivation is also affected by cultural and behavioural factors. The economic motivation to commit fraud is bound to be lower when the seller and buyer have a long-term relationship and history of conducting mutually beneficial transactions. Motivation is increased by personal or commercial desperation. A business that is protecting a valuable brand will be less motivated to commit fraud than a trader of fungible commodities.

**Economic and market factors**

- Special attributes that determine value
- Financial strains
- Level of competition
- Supply/demand and pricing
- Competitive strategy
- Economic health or conditions

**Cultural and behavioural factors**

- Personal gains or desperation
- Ethical business culture
- Corruption level
- Victimisation
- Blackmail

“Where there is money, there’s crime; where there is big money, there’s big crime.”
Controls

A food company’s primary fraud prevention measures are its food safety management and quality control systems, as well as food quality and safety managers and staff. External controls include food safety agencies, anti-fraud regulations, and law enforcement agencies. Employees, suppliers and customers also play important roles in reducing the risk of food fraud. 20

Specific controls include: 21

- Information systems (e.g. traceability, mass balance)
- Fraud monitoring and verification systems
- Whistleblowing guidelines and protections
- Ethical codes of conduct
- Legal framework and enforcement
- Social control chain network
- Contractual requirements
- Employee integrity screening

20. SSAFE Food Fraud Vulnerability Assessment Tool, (Annex II), 16 Dec 2015
21. Wageningen University & Research
In a study of English-language academic and media reports, researchers identified the following food products as among the most frequently targeted by fraudsters:  

<table>
<thead>
<tr>
<th>Olive oil</th>
<th>Wine</th>
<th>Fish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Honey</td>
<td>Vanilla extract</td>
<td>Apple juice</td>
</tr>
<tr>
<td>Saffron</td>
<td>Milk</td>
<td>Maple syrup</td>
</tr>
<tr>
<td>Coffee</td>
<td>Orange juice</td>
<td>Chili powder</td>
</tr>
</tbody>
</table>

By category, the food products most frequently cited in scholarly reports were oils, milk, fruit juice/concentrate/puree, and spices. A quick application of the “opportunity + motivation – controls” framework makes it easy to understand why criminals would choose these products for their illicit activities.

Highly competitive markets create strong motivation to find low cost substitutes. Animal by-products (ABPs) or illegal carcasses are notable examples. The European Commission’s Food Fraud Network reported that the majority of its cases in 2015 involved ABPs. In China, a government insurance program compensates farmers for pigs that become sick or die. In a 2015 operation, police broke up a network that illegally traded and processed those carcasses. They arrested 110 people across 11 provinces and confiscated 1,000 tonnes of meat and 48 tonnes of cooking oil.

The increasingly global nature of supply chains multiplies the risk and geographic reach of food fraud, as illustrated in last year’s case of ground peanut shells being added to cumin. With cumin crop yields 40-50% lower than normal due to high temperatures, the economic motivation was not hard to see. While laboratory testing discovered the adulteration in the US and Europe, the exact source of contamination was practically impossible to pinpoint, with three quarters of the world’s cumin originating in India.

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23. European Commission, Food Fraud Network Activity Report 2015
Food fraud challenges

Industry-wide challenges

The challenges of combatting food fraud are complicated by the many opportunities for adulteration and deception, as well as the growing complexity and geographic reach of today’s multi-tiered production and supply chains. Some industry-wide challenges include:

• **Difficulty of detecting food fraud**
  
  Detecting food fraud is difficult because deception is a primary objective of the fraudster. Testing is not only expensive, but most testing methods are designed for a specific known adulterant-substance. Criminals will always be searching for new substances or methods that are not targeted or detectable by current systems. Effective anti-fraud testing programs require continuous monitoring of incidents and market conditions to target the current, most likely adulterant-substances.

• **Lack of upstream supply chain visibility**
  
  Regulations in major markets such as China, the US and the EU generally require one-up one-down traceability. Sourcing practices of tier 1 suppliers are not always assessed or understood and visibility to tier 2 suppliers is often limited.

• **Under-investment in supply chain risk management**
  
  There are clear financial incentives to optimise supply chains for cost efficiency and to minimise working capital. But with shareholders focused on short-term results, it is difficult to quantify the financial benefits of time and money spent on risk management. Effective supply chain risk management requires significant investment in planning, analysis and management information systems.
Additional challenges in China

As China’s production, processing, manufacturing and distribution have grown in scale and diversity, the opportunities and motivation for food fraud have increased dramatically. After an influx of investment and the introduction of new manufacturing and processing technology, agricultural inputs, and chemical additives, China now has some of the world’s largest food companies. At the same time, the sector remains extremely fragmented with millions of small operators.

Some notable aspects of China’s food industry landscape make the prevention of food fraud especially difficult.

• **Sheer volume of production**

Since 1980, China’s crop production has grown by more than 200%, meat production (including poultry) has grown by more than 500%, and dairy output has increased by more than 3000%. China produces and consumes half of the world’s pork, and is the largest producer of fish, eggs, rice, wheat, fruit, vegetables and tea; the second largest producer of corn and chicken; and the third largest producer of milk.

• **Highly fragmented production, processing, distribution and retail**

This enormous volume of food is produced in an incredibly fragmented industry. Although large-scale livestock and horticulture operations are increasing, agriculture is still mainly conducted by a vast number of small farms. Processing and manufacturing are consolidating, but there remain large numbers of small workshops. Distribution and retail are also highly fragmented.

In this environment, it is very difficult for the government to supervise and monitor all producers and processors for adherence to best practices, and it is especially difficult to catch small-time fraudsters operating out of hidden workshops. It is also difficult for corporations to ensure that fraudulent products do not enter their supply chain.

*figure 3: Relative levels of fragmentation in China and the US agriculture sectors*

<table>
<thead>
<tr>
<th></th>
<th>Number of farms with cropland 26</th>
<th>Number of farms that raised pigs for slaughter 27</th>
<th>Number of farms that raised broilers 28</th>
</tr>
</thead>
<tbody>
<tr>
<td>China (2006)</td>
<td>184 million</td>
<td>52 million</td>
<td>24 million</td>
</tr>
<tr>
<td>US (2012)</td>
<td>1.6 million</td>
<td>56 thousand</td>
<td>33 thousand</td>
</tr>
</tbody>
</table>

• **Limited technical expertise in small operators**

The variety of additives and industrial chemicals is immense in China’s rapidly industrialising economy. Safely applying these to food products, either legally or illegally requires some level of training and expertise.

Criminal operations are likely to be small-scale and lacking the expertise to understand whether their adulterations or other modifications will be harmful to human health. Legitimate small operators and even consumers also might lack the expertise to distinguish between fraudulent products and authentic ones.

This is made more difficult by the lack of standardisation that comes with a fragmented industry landscape, as well as the deliberate deception that is a fundamental aspect of food fraud.

• **Highly competitive markets and thin margins**

China’s food sector is one of the most competitive in the world, with razor thin margins. Small businesses operating in high pressure situations may be tempted into using fraudulent products to cut costs and avoid bankruptcy.
The GFSI vision is that the mitigation of food fraud and its potential impact on consumers’ health will become an integral part of a company’s food safety management system.

The GFSI Guidance Document Version 7, to be released in late 2016, will require companies to:

- Perform a food fraud vulnerability assessment to identify potential vulnerabilities and prioritise food fraud measures.
- Have a food fraud vulnerability control plan in place that specifies the control measures the organisation has implemented to minimise the public health risks from the identified food fraud vulnerabilities and be supported by the organisation’s Food Safety Management System.

During a food safety certification audit, conducted against GFSI recognised schemes, the auditor will review the documentation related to the vulnerability assessment process and confirm that a comprehensive control plan has been developed and implemented by the company.  

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GFSI compliance will soon require companies to conduct a food fraud vulnerability assessment and to prepare a food fraud mitigation plan.

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29. GFSI Position on Mitigating the Public Health Risk of Food Fraud, 2014
GFSI currently recognises the following schemes:

- Primus GFS Standard
- Global Aquaculture Alliance Seafood
- Global G.A.P. Produce Safety Standard
- Global Red Meat Standard
- SQF Code
- IFS Food Standard
- BRC Global Standard for Food Safety,
- BRC Global Standard for Packaging and Packaging Materials
- BRC Global Standard for Storage and Distribution
- IFS PACsecure
- BAP Seafood Processing Standard
- Global G.A.P. Integrated Farm Assurance Scheme
- FSSC 22000
- Canada GAP
- IFS Logistics
- China HACCP

In 2015, China HACCP became the first government-owned scheme to be recognised by GFSI.

Beyond the food safety vulnerabilities, food fraud creates tremendous economic harm and undermines the trust in the food supply chain. Food fraud undermines the consumer trust of industries, companies, and even public institutions. Addressing and preventing food fraud is important to sustain economic growth, to maintain the flow of food across longer supply chains, to increase consumer trust in the economy, and to maintain social harmony.30

30. Professor John Spink, Director of the Food Fraud Initiative Michigan State University
To support compliance with the new GFSI guidelines, we can deploy our risk analysis expertise to conduct a thorough food fraud vulnerability assessment. PwC employs a food fraud vulnerability assessment framework that is based on the study of criminal behaviour and decision making, and applies fraud theory to support the identification of the vulnerabilities. This framework was developed in cooperation with SSAFE, the University of Wageningen RIKILT and the Free University of Amsterdam.

The assessment framework can be applied anywhere in the food supply chain, from animal feed and primary production to manufacturing and catering. It is most useful when conducted on individual ingredients, products, geographical units or facilities or production lines. The units on which the assessment is conducted can be prioritised by economic value, or by the potential for fraud-related safety risks, brand damage or financial loss.

The assessment consists of 50 questions that cover the three main elements of food fraud vulnerability, i.e. opportunity, motivation and control measures. The “Opportunities” and “Motivations” sections assess risks related to your company’s internal and external environment. The “Fraud Control Measures” section looks at your company’s existing controls.

With our expertise in risk assessment, internal controls, and supplier management, PwC can conduct a food fraud vulnerability assessment, followed by the design and implementation of a tailored food fraud risk mitigation plan.
• **Opportunities**

The Opportunities section looks at vulnerability to criminal activity. It includes eleven questions related to ingredients, product and process characteristics, features of the chain/industry network, and historical evidence of fraud with particular food products and ingredients. (Please refer to Figure 5 on page 20 for an illustrative summary of a food fraud opportunities assessment.)

• **Motivations**

This section assesses the types of motivations individuals may have to commit fraud for a particular ingredient or food product. It includes twenty questions that cover pricing and market characteristics, history of fraud and other criminal offences for the industry and individual parties in the supply chain, as well as the economic challenges for the company, suppliers and the industry. (Please refer to Figure 6 on page 21 for an illustrative summary of a food fraud motivations assessment.)

• **Control measures**

The Control Measures section assesses the measures currently in place to help prevent fraud. This section consists of nineteen questions about mitigation and contingency measures, including internal hard controls, internal soft controls, and external controls of suppliers/customers and the wider sector environment. (Please refer to Figure 7 on page 22 for an illustrative summary of a food fraud controls assessment.)

For more detailed insight into the framework, the Food Fraud Vulnerability Assessment tool can be downloaded free of charge, in Chinese or English, at [www.pwc.com/foodfraud](http://www.pwc.com/foodfraud), or in spreadsheet form at [www.ssafe-food.org](http://www.ssafe-food.org). The assessment is also available on the Apple App Store and Google Play.
Food fraud mitigation plan

GFSI compliance will require a documented food fraud mitigation plan. The plan must be designed to address the risk factors identified in the food fraud vulnerability assessment. It will be different for every company depending on the types of risks identified, as well as the nature of the companies’ ingredients, products, and geographic presence.

PwC can help you design and implement an food fraud risk mitigation plan, employing our extensive experience in risk management, internal controls and supplier management. A food fraud mitigation plan will address areas such as governance processes, company ethics, workplace culture, sourcing and supplier management, and controls over processing and distributing food to consumers.
With extensive experience and expertise in risk assessment, supplier management and internal controls, PwC’s Food Supply and Integrity Services team can help you conduct a thorough food fraud risk assessment, followed by the design and implementation of a tailored food fraud risk mitigation plan.
Appendix: Examples of Food Fraud Vulnerability Assessment Results

Figure 5: Illustrative example of the Opportunities segment of the food fraud vulnerability assessment
Figure 6: Illustrative example of the motivations segment of the food fraud vulnerability assessment
<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>32.</td>
<td>Fraud monitoring system raw materials</td>
</tr>
<tr>
<td>33.</td>
<td>Verification of fraud mon. system raw materials</td>
</tr>
<tr>
<td>34.</td>
<td>Fraud monitoring system final products</td>
</tr>
<tr>
<td>35.</td>
<td>Verification of fraud monitoring system final products</td>
</tr>
<tr>
<td>36.</td>
<td>Information system own company</td>
</tr>
<tr>
<td>37.</td>
<td>Tracking and tracing system own company</td>
</tr>
<tr>
<td>38.</td>
<td>Integrity screening own employees</td>
</tr>
<tr>
<td>39.</td>
<td>Ethical code of conduct own company</td>
</tr>
<tr>
<td>40.</td>
<td>Whistle blowing own company</td>
</tr>
<tr>
<td>41.</td>
<td>Contractual requirements suppliers</td>
</tr>
<tr>
<td>42.</td>
<td>Fraud control system supplier</td>
</tr>
<tr>
<td>43.</td>
<td>Mass balance control supplier</td>
</tr>
<tr>
<td>44.</td>
<td>Tracking and tracing system supplier</td>
</tr>
<tr>
<td>45.</td>
<td>Social control chain network</td>
</tr>
<tr>
<td>46.</td>
<td>Fraud control industry</td>
</tr>
<tr>
<td>47.</td>
<td>National food policy</td>
</tr>
<tr>
<td>48.</td>
<td>Law enforcement local chain</td>
</tr>
<tr>
<td>49.</td>
<td>Law enforcement chain network</td>
</tr>
<tr>
<td>50.</td>
<td>Contingency</td>
</tr>
</tbody>
</table>

**Figure 7: Illustrative example of the Food Fraud Controls segment of the food fraud vulnerability assessment**

<table>
<thead>
<tr>
<th>Certainty</th>
<th>Control measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very certain</td>
<td>Reasonably certain</td>
</tr>
<tr>
<td>Uncertain</td>
<td>Low</td>
</tr>
<tr>
<td>Medium</td>
<td>High</td>
</tr>
</tbody>
</table>

Legend: Very certain, Reasonably certain, Uncertain, Low, Medium, High
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