Chapter 1
Introduction (Part 1 of 2): Food Fraud Definitions and Scope

Summary
This chapter presents the introduction to the scope and definitions related to food fraud. The next chapter introduces many of the fundamental concepts. Before getting into a structured review of the definitions and related terms, there will be a foundation setting task that considers the end goal such as why do you care, how to start, how much is enough, and is the government doing enough.

The Key Learning Objectives of this chapter are
- (1) **Preface to Introduction**: before reviewing the concepts, there will be a consideration of why this is a worthwhile effort for the ultimate questions such as "how to start?" and "how much is enough?"
- (2) **Definitions:** to review the types of food fraud and also related terms such as food defense, food authenticity, food security, and others. This also considers related terms including some common terms such as adulteration, authenticity, and integrity.
- (3) **Relationship of Food Risk Concepts:** the relation between food quality, food safety, food fraud, and food defense is presented in the Food Risk Matrix.

On the Food Fraud Prevention Cycle (FFPC), this chapter addresses the theoretical foundation concepts related to criminology and the fraudster "(A) Theoretical Foundation" (Fig. 1.1).

Introduction

This chapter covers the basics of food fraud prevention. Food fraud and the focus on prevention have matured as a discipline—and possibly as a science—enough to present a full book and more than "what is it" or "someone should do more." A set of unique terms and methods are being developed and updated. The research has started in food science and food authenticity before expanding to law and

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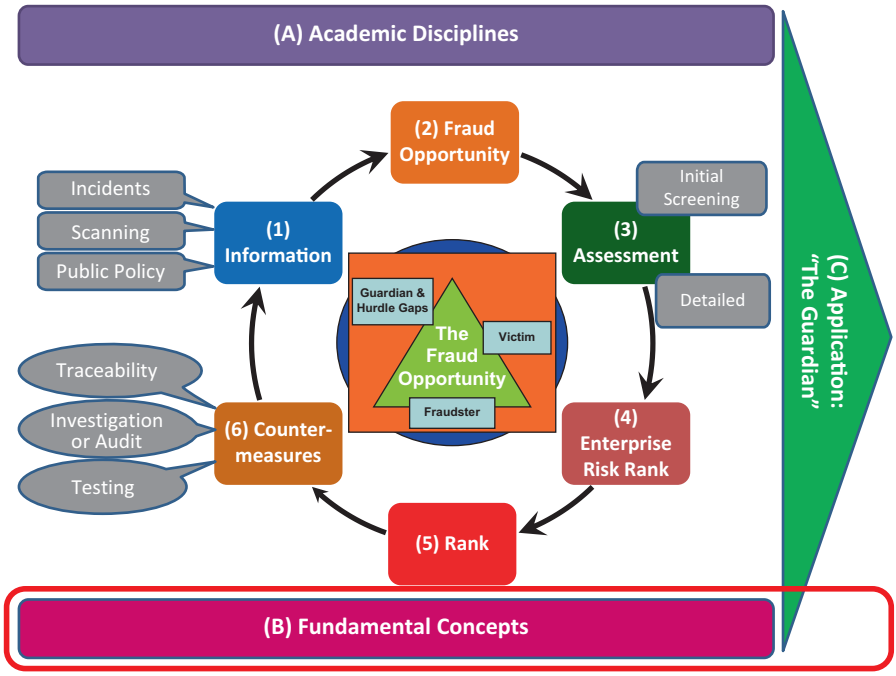

Fig. 1.1 Food Fraud Prevention Cycle—where this chapter applies to the overall concept: "(B) Fundamental Concepts". (Copyright Permission Granted) (Spink 2014a, b; Spink et al. 2019)

criminology through business and supply chain management to a unique, hybrid, interdisciplinary approach. Overall there is a body of work focused on policy and strategy development. This book represents that broad, interdisciplinary approach to one central system that is presented as the Food Fraud Prevention Cycle (FFPC).

A first question is whether the focus should be problem-based or solution-based. Prevention starts with understanding the root cause or the problem, and then this is a problem-based approach. If a technology is found and then followed by a search for applications, then this is a solution-based approach. The overall food fraud prevention research—consistent with previous product counterfeiting research—is "problem-based" not "solution-based." This means the activity starts with a focus on the "problem" and then seeks the most efficient and effective "solutions" (Fig. 1.2). Many times there is a backward process of a "solution looking for a problem." When starting with the problem, the specific problem can be clearly and explicitly defined using specific incident factors. Often there are a series of root cause factors that create the fraud opportunity. Each root cause factor may require a separate—though often very simple and low or no cost—risk treatment. Then, a solution can be sought that directly and efficiently solves specific aspects of the problem.

The best place to start this Introduction chapter and the book is to review the definition and scope. Using ISO 31000 Risk Management standards, this would identify

Fig. 1.2 Example of identifying the fraud opportunity, the defining specific problems before seeking precise solutions

the very first step of "Establishing the context" (ISO 2009). While a specific department or agency may be accountable or responsible for one type of problem, the companies or countries need to address *all* food risks not just public health hazards. Any starting point that does *not* begin with the "all risks approach" will likely face resource-allocation challenges due to an incomplete proposal that does not calibrate this risk with all other risks.

Key Learning Objective 1: Preface to Introduction—Why Act? Do I Need to Act?

This section reviews a few foundational concepts that should be considered through to the review and management of food fraud prevention. These may seem overly simplistic reviews, but they are essential. The focus is on supporting efficient and effective resource allocation to maximize the ultimate goal which is to protect customers from harm by reducing the fraud opportunity. These key questions will not be answered yet since the first step is "Establishing the context."

The Key Learning Objectives of this section are

- (1) "How to start?" and "how much is enough?"
- (2) "Who cares?" and "why do I care?"
- (3) Then, is the government doing "enough"?

Do I Need to Act? How Much Is Enough? How to Start?

Yes, "food fraud" is bad. Yes, "more" should be done. Ok, now what? Is food fraud the top priority for your entire enterprise? Is it a top-10 priority? Should you drop everything right now and call the president of your company? Should you stop reading and send a note to your crisis management team? Can you wait until you get done reading this chapter? Can you wait until tomorrow? Do you have a process to prescribe your activity?

Then, to address "how much is enough," "I need more funding" is a desperate plea and not a strategic proposal. Stating "we don't have any more budget money" is not a tactical position and not risk-based justification. If your company has $1 million to spend on *one* project, should it be to address food fraud? Can it identify competing projects that are outside the scope of food fraud, food safety, or all food risks? What specific food fraud prevention project would you propose, *and* could you defend that as the #1 project for all the possible food fraud prevention countermeasures and control systems? Very few people or companies can answer "yes." Some people even become belligerent when pressed on these questions that they now realize they cannot answer.

The lack of a clear method is the fault and responsibility of the theorists including academics. It is *our* fault that a question exists and *our* collective responsibility to address this unmet need.

The first step in recovery is admitting there is a problem.[1] The next step is to understand the root cause of the dysfunction, and ISO 31000 Risk Management identifies this in "Establishing the context" (ISO 2009).

The food fraud problem is based on the following general risk analysis concepts such as ISO31000, Six Sigma, or others; the steps to address food fraud include (Spink et al. 2019):

1) **Establishing the context**

   a) **What is food fraud?**

   - There are many publications that define the concept and provide examples of incidents.

   b) **Is it a problem?**

   - Next, the publications expanded to discuss incidents and to define the public health and economic harms. This also includes examples of how and why incidents occurred. It sometimes also includes reviews of laws and regulations.

[1] The term "problem" is used in criminology. **Problem**: "…the basic unit of police works rather than a crime, a case, calls, or incidents. A problem is something that concerns or causes harm to citizens, not just the police. […] Addressing problems means more than quick fixes: it means dealing with conditions that create problems" (Clarke and Eck 2005) Clarke, Ronald V and John E Eck (2005). "Crime analysis for problem solvers in 60 Small Steps." Washington, DC: Center for Problem Oriented Policing.

c) **How to detect specific fraud acts, are new tests needed, and then validate the test methods?**

- The vast majority of food fraud published research is related to test methods, results, and either validation or verification of both.

2) **Do I need to act?**

- As the basics are becoming more clearly defined or defended, there is beginning to be a research focus on decision-making and specific regulatory or commercial requirements. For example, is there a law, a company compliance requirement, or a direct order from your superior that requires the activity? Alternatively, is it just something you "should do?"

3) **How to start food fraud?**

a) **What to do?**

- This is covered, in part, above in the research on detection tests.

b) **How to measure success?**

- This is probably one of the currently most under-researched areas. It appears that quality management concepts will present the best opportunity for effective and efficient success metrics. Utilizing quality management principles such as critical control points is well known. For public policy or law enforcement agencies, this will be a bigger challenge since the agencies have really been set up to respond to incidents or current problems rather than strategic prevention.

c) **How much is enough?**

- This question applies to immediate activity or longer-term resource allocation. There is often a gut feel for how much you should do (or is really how little do you dare *not* to do?). A first judgment is if there is a regulatory definition of compliance. Is there a food safety audit nonconformity that needs to be rectified? Is there is an internal control or COSO type audit nonconformity that need to be rectified? The next judgment is if there is an enterprise-wide risk or vulnerability compliance system such as COSO type Enterprise Risk Management. For a new or recently defined problem type, it is logical that there is not yet a structure or process for decision-making for "how much is enough."

4) **Continuous review and process improvement.**

- Identify critical factors that can be assessed and monitored.

Next, the objective is to explore these questions and present insight into the underlying factors. Addressing these questions will help inform resource-allocation decision-making.

Who Cares? Why Do I Care? Why Does Anyone Care?

These are conceptual questions at the core of the problem and challenge. "'Someone' in the enterprise must be responsible for food fraud prevention, right?" The response is "Ok then who? Tell me a name." What often follows is a blank stare or even an increased agitation.

"Who cares?" This is more a question of "who acts?" and "who has a budget?" This is a challenging question for countries as well as companies. There is a belief that "more" should be done, but at least at the start, there is no budget and no free resources (Spink 2014a, b). There is a gap, and without clear assignment of the problem to someone specific—such as when using the Food Risk Matrix—then often nothing gets done. "That's bad, but it's not my job." When nothing gets done, then incidents such as melamine or horsemeat are fraud opportunities that could become food fraud incidents. The answer to this question is based on strategy or policy commitments and then defined by the prevention strategy assigned in "key job responsibilities."

"Why do I care?" You have a set of key job responsibilities or success metrics. Food fraud is probably not specifically listed… at least not yet. I've heard something like "I'm responsible for food ingredient contamination, so I'm not concerned with all types of fraud." Ok, understood. However, by stating this, you individually and personally have knowledge that food fraud is probably not being completely addressed at your company. You have knowledge of a regulatory violation. You probably have a role as a "mandatory reporter" of violations—this is especially true and could be literally criminal if you have knowledge that a law is being broken. If there is a death from food fraud, your knowledge and lack of activity could be criminal. Will criminal prosecution always follow, of course not, but it is possible, and do you want to take that chance? Also if you know of smuggling or a criminal act—such as the weights of fish being not accurately listed on a label or manifest—your lack of activity could be criminal. If that fish was imported and sold in the USA, you would have knowledge of "smuggling," and each incident carries a maximum penalty of 20 years in prison (see keyword "smuggling" in later sections on laws and regulations).

"Why does anyone care?" This is an important question to understand the priority for governments or consumers. Do they understand food fraud? Are they outraged when it occurs? What type of food fraud outrages them the most that leads to more enforcement or prosecution? The bottom line for a company is that food fraud is *illegal* and could lead to a product recall at "best" and criminal prosecution and incarceration "at worst" especially if the incident led to a death or deaths. Regardless of the level of enforcement and prosecution, food fraud must be addressed. Following upon this, the first steps and countermeasures and control systems are often *not* costly or time-consuming; the only reason to *not* start would be a lack of a plan.

Over time, the needs and the challenges have been more clearly identified, and the way forward is now more apparent. These questions are addressed through an interdisciplinary, holistic, all-encompassing focus on food fraud prevention.

Is the Government Doing "Enough"?

In the past food fraud was a known problem, but there was not enough information to really establish a common, practical, preventative approach. In a 2010 government public meeting, I was asked if I thought "industry was doing enough to address food fraud," and I responded with "based on the way we academics and the laws have defined food fraud and prevention, I that think industry and agencies are doing a fine job." The key is how food fraud is defined and addressed in the laws and regulations. The focus should be on who is assigned the task. With the awareness of the enterprise-wide risk, the leadership is presented with a clear path forward. The leadership is "accountable" for this "inherent risk" and assuring that food fraud prevention is explicitly addressed. There are great strides being made considering how little is really known about food fraud prevention.

Key Learning Objective 2: Definitions

This section reviews the interdisciplinary nature of prevention by considering how the "fraud opportunity" is created and the many academic disciplines that help understand the optimal countermeasures and control systems.

The Key Learning Objectives for this section are

- (1) To review the underlying concepts of framing a problem
- (2) To review the definition and scope of food fraud
- (3) To review the types of food fraud

General Concepts

Over time there has been more and more clarity of the need to continually explore and present definitions of key terms. It is fascinating how often there is confusion or debate on even the most basic terms or concepts. Over time there has been a collective embrace of the food fraud term as well as the focus on prevention. More recently there is an awareness that the root cause is a human adversary so the research must include social science and criminology. The diagnosis of the problem includes a root cause that is understood by applying criminology. Also, as programs are developed, there is an identification of the need to focus on resource-allocation decision-making to address the question of "how much is enough."

This book will begin with a brief statement of the definitions and scope before moving to the general food fraud prevention concepts.

Undoubtedly product fraud has been conducted since the start of all commerce, and food fraud has been recorded in history since at least 960 BCE during the Song dynasty in China (Wu et al. 2017). What starts as a savvy negotiation can evolve into deception.

Before reviewing the definition and scope of food fraud, it is important to start with the base terms of food and fraud:

- *Food (Codex):* **"…** means any substance, whether processed, semi-processed or raw, which is intended for human consumption, and includes drink, chewing gum and any substance which has been used in the manufacture, preparation or treatment of "food" but does not include cosmetics or tobacco or substances used only as drugs."
- *Fraud (COSO):* "…is any intentional act or omission designed to deceive others, resulting in the victim suffering a loss and/or the perpetrator achieving a gain" (COSO 2016).
- *Fraud (Codex): Codex Alimentarius* does *not* seem to have defined this basic term.

Combining the basic terms and the modern application, a simple, holistic definition is:

- *Food fraud* (basic short version): intentional deception for economic gain using food

There is a hesitance in providing a reference for this definition here since this is such a general concept. What is important is the broad definition which covers all food-related product fraud. The broad definition covering all types of fraud and for all products is often a new perspective since there has usually previously been a focus on the most prevalent public health threat which is from a dangerous ingredient intentionally added to the product. It is generally considered that the most dangerous—but by no means, the only—acts are from an adulterant, and the act is adulterant-substances and product counterfeiting.

The research and development of a more detailed definition of food fraud were published in a peer-reviewed, scholarly 2011 article "Defining the Public Health Threat of Food Fraud" (Spink and Moyer 2011a, b). This research activity began by reviewing laws, regulations, standards, and certifications. This then reviewed scholarly articles for food fraud and related topics. Through this research, the broad definition was developed and published. This definition has been quoted and references for the industry standard developed by the Global Food Safety Initiative (GFSI),[2] the European Commission's Referendum on Food Fraud, the UK DEFRA Elliott Review, the US Congressional Research Service, the CODEX Electronic Working

[2] GFSI may not be as recognized by some as the standards from BRC, IFS, FSSC 22000, SGS, or others. GFSI is a major emphasis in this report since the requirements are widely adopted. GFSI will be covered in more detail later. It is important to note that GFSI establishes the expectation or benchmark for what should be in a Food Safety Management System (FSMS). GFSI does not create standards but "recognizes" or endorses standard organizations that are referred to as Certification Program Organizations (CPOs—formerly referred to as scheme owners). The manufacturers that would be certified to an FSMS are from FSSC 22000, BRC, and IFS or others. The standards are audited by Certification Bodies (CBs). The CBs are recognized or endorsed by the CPOs to conduct the audits. Not every auditor or CB can provide an officially certification for every CPO.

Group on Food Integrity and Food Authenticity, and ISO 22380 on product fraud prevention (among others see: EC 2014; CODEX 2017; GFSI 2017; ISO 2018). It has been adopted as a de facto definition of food fraud and the related deceptive economically motivated acts. From the original NCFPD backgrounder report, that was the core research for the later Journal of Food Science publication:

- *Food Fraud:* "Is a collective term used to encompass the deliberate and intentional substitution, addition, tampering, or misrepresentation of food, food ingredients, or food packaging; or false or misleading statements made about a product, for economic gain. Food fraud is a broader term than either the economically motivated adulteration (EMA) defined by the Food and Drug Administration (FDA) or the more specific general concept of food counterfeiting" (Spink and Moyer 2011a, b).
  - **Product Fraud**: Wrongful or criminal deception that utilizes material goods for financial or personal gain Note 1 to entry: Fraud means wrongful or criminal deception intended to result in financial or personal gain that creates social or economic harm; Note 2 to entry: Products include electronic media carried on material goods; Note 3 to entry: Fraud related to digitally transmitted electronic media shall be considered separately" (ISO 2018).

A longer, more comprehensive definition is:

- ***Food Fraud*** **(basic long version):** "Is a collective term used to encompass the deliberate and intentional substitution, addition, tampering, or misrepresentation of food, food ingredients or food packaging, or statements about the product for economic gain. Food fraud is a broader term than both the Food and Drug Administration's (FDA) definition of economically motivated adulteration (EMA) or the more specific general concept of food counterfeiting" (Spink and Moyer 2011a, b).

For review, two Global Food Safety Initiative (GFSI) definitions are presented here and demonstrate the evolution of the concept and similarity of scope (GFSI 2014, 2017).

- **Food Fraud** (GSFI 2014): "Including the subcategory of economically motived adulteration, is of growing concern. It is deception of consumers using food products, ingredients and packaging for economic gain and includes substitution, unapproved enhancements, misbranding, counterfeiting, stolen goods, or others" (GFSI 2014) .
- **Food Fraud** (GFSI 2017)**:** "A collective term encompassing the deliberate and intentional substitution, addition, tampering or misrepresentation of food, food ingredients or food packaging, labeling, product information or false or misleading statements made about a product for economic gain that could impact consumer health" (GFSI 2017).

A closely related—and often confused—term is "economically motivated adulteration." This term came into prominence when the subject of a US FDA Public Meeting (FDA 2009). The definition was identified as a "working definition" in the meeting invitation was published in the US *Federal Register*. This became and remained the FDA "working definition." The term has often been incorrectly used as the same as food fraud.

The 2009 FDA Working Definition of EMA—which was confirmed in 2018 by FDA as still current—is provided here and was (emphasis added) (FDA 2009):

- "***Economically Motivated Adulteration*** (FDA) Working Definition (emphasis added): "For purposes of this public meeting, FDA proposes a working definition of EMA as the fraudulent, intentional substitution or addition of a substance in a product for the purpose of increasing the apparent value of the product or reducing the cost of its production, i.e., for economic gain. EMA includes dilution of products with increased quantities of an already-present substance (e.g., increasing inactive ingredients of a drug with a resulting reduction in strength of the finished product, or watering down of juice) to the extent that such dilution poses a known or possible health risk to consumers, as well as the addition or substitution of substances in order to mask dilution" (FDA 2009).
- **Economic Adulteration** is an earlier and related term that many groups were proactively using especially after the melamine in infant formula and pet food. The term "economic adulteration" was a common term. This term seems to be first used in the USA in the 1996 GAO report on fruit juice adulteration (GAO 1995). Regarding the "economic adulteration" incidents in the GAO Fruit Juice report, there was an emphasis on "…they pose little threat to the public's health and safety." There are reasons why this is a problematic term to use. First, it insinuates adulteration and not the broader fraud concepts. Second, by the grammatical construction of the phrase, it insinuates that the impact or result is only economic harm. Later, there was a trend in the US to evolve the concept of "economically motivated adulteration." This still was limited to adulterant-substances but was a notable shift to focus on the motivation or intent.

A close review of the FDA working definition of EMA, it becomes clear that EMA is a "substance" for economic gain so would be a sub-category of food fraud including only the "adulterant-substance" type. It appears from the scope that this definition only applies the EMA term when there is a "known or possible health risk." If this is a correct interpretation, then it is possible that the horsemeat in the beef incident would not technically be classified as an FDA defined "EMA" incident since there was no known health risk. The debate is futile since any all types of food fraud for all products are illegal under the U.S. Food Drug & Cosmetics Act (FDCA) sections on "Adulterated Foods" and also "Misbranded Foods" (FDA 2015). Also, the U.S. FSMA law section on "Hazard Analysis" requires "a documented hazard analysis regardless of the outcome" and including "intentional acts for economic gain" (FDA 2011, 2015).

Though the basic scope is defined, the definition, challenges, thoughts, and derivation of the definitions will be reviewed in much more detail later.

Types of Food Fraud

Before 2011, the food fraud term has been previously used, such as by the UK Food Standards Agency (UK FSA), but the definition and scope had not been rigorously or thoroughly researched as the subject of project or publication. Other researchers—such as UK FDA Woolfe and Primrose as well as Elliott et al. and van Ruth et al.—widely published on the topic with a focus on authentication and testing not the scoping of the basic problem, root cause, or prevention strategies (Primrose et al. 2010; Huisman and Spapens 2016; Barnard and O'Connor 2017; van Ruth et al. 2017, 2018).

A 2011 research publication presented the definition and scope of food fraud with a list of types of food fraud. This was expanded to include other terms such as are used by the Global Food Safety Initiative (GFSI). This work is correlated to a 2015 article which published the Defining the types of counterfeiters, counterfeiting, and offender organizations (Spink et al. 2013). This work drew heavily upon other research in intellectual property rights counterfeiting of many products including food, medicines, medical devices, automobile parts, luxury goods, consumer electronics, industrial electronics, and others. It was especially important to identify types of fraud, to define where and how intellectual property rights counterfeits fit, and to define that some types of fraud were not a violation of a law. For example, in most cases, diversion is not illegal but could be a violation of the commercial agreement.

The following table is included to provide the types of food fraud examples and the public health vulnerability (Table 1.1) (Spink and Moyer 2011a, b).

The entire research project evolved and expanded to work through several concepts at once including reviewing the food fraud incident types, the food risks, the food protection plan, and in applying the Situational Crime Prevention and the Crime Triangle (Table 1.2). This considered known incidents with more detailed research that would follow later. It was especially important to identify adulterant-substances as only one of the types of food fraud.

Regarding the "adulterant-substance" term, the definition and scope have been codified in 2018 where ISO 22380 includes a table of "Types of Product Fraud" including counterfeiting, IP rights infringement, adulterant-substance, tampering, substitution, simulation, diversion, theft, and overrun (ISO 2018). The description is: "A component of the finished product is fraudulent; example: Adulteration of infant formula by melamine in China, Estimate 300,000 victims including 6 infants dying; potential consequence is low quality or unsafe products leading to human or environmental harm" (ISO 2018).

Table 1.1 Food fraud incident types (in (Spink and Moyer 2011a, b)

Term	Definition	Example	Potential public health threat that may lead to illness or death
Adulterant-substance (adulterate, adulterated, etc.)	A component of the finished product is fraudulent	Melamine added to milk	Fraudulent component
Tamper	Legitimate product and packaging are used in a fraudulent way	Changed expiry information, product up-labeling, etc.	Fraudulent packaging information
Overrun	Legitimate product is made in excess of production agreements	Underreporting of production	Fraudulent product is distributed outside of regulated or controlled supply chain
Theft	Legitimate product is stolen and passed off as legitimately procured	Stolen products are comingled with legitimate products	Fraudulent product is distributed outside of regulated or controlled supply chain
Diversion	The sale or distribution of legitimate products outside of intended markets	Relief food redirected to markets where aid is not required	Shortages or delays of relief food to needy populations
Simulation	Illegitimate product is designed to look like but not exactly copy the legitimate product	"Knock-offs" of popular foods not produced with same food safety assurances	Fraudulent product of lesser quality
Counterfeit	All aspects of the fraudulent product and packaging are fully replicated	Copies of popular foods not produced with same food safety assurances	Fraudulent product

Adapted from Spink (2007, 2009a, b)
Note: In each case, fraudsters may not be following Good Manufacturing Practices (GMPs), Good Agricultural Practices (GAPs), or Good Hygiene Practices (GHPs)

Table 1.2 Food fraud types, definitions, and examples (as published in (GFSI 2018) which references (Spink and Moyer 2011a, b; GFSI 2014; SSAFE 2015; PWC 2016; Spink et al. 2016a, b; GFSI 2017))

GFSI[a] type of food fraud	Definition from SSAFE[b]	Examples from GFSI FFTT[c]	General type of food fraud
Dilution	The process of mixing a liquid ingredient with high value with a liquid of lower value	Watered-down products using non-potable/unsafe water Olive oil diluted with potentially toxic tea tree oil	Adulterant-substance (adulterant)
Substitution	The process of replacing an ingredient or part of the product of high value with another ingredient or part of the product of lower value	Sunflower oil partially substituted with mineral oil Hydrolyzed leather protein in milk	Adulterant-substance or tampering
Concealment	The process of hiding the low quality of food ingredients or product	Poultry injected with hormones to conceal disease Harmful food colouring applied to fresh fruit to cover defects	Adulterant-substance or tampering
Unapproved enhancements	The process of adding unknown and undeclared materials to food products in order to enhance their quality attributes	Melamine added to enhance protein value Use of unauthorized additives (Sudan dyes in spices)	Adulterant-substance or tampering
Mislabelling	The process of placing false claims on packaging for economic gain	Expiry, provenance (unsafe origin) Toxic Japanese star anise labeled as Chinese star anise Mislabeled recycled cooking oil	Tampering
Grey market[d] production/ theft/ diversion	Grey market production/ theft/ diversion are out of scope for this tool. However, it may be picked up anyway	Sale of excess unreported product Product allocated for the US market appearing in another country	Overrun, theft, or diversion[e]
Counterfeiting	The process of copying the brand name, packaging concept, recipe, processing method, etc. of food products for economic gain	Copies of popular foods not produced with acceptable safety assurances Counterfeit chocolate bars	Counterfeiting

Notes:
[a]GFSI—Global Food Safety Initiative
[b]SSAFE—Safe Secure and Affordable Food For Everyone
[c]GFSI FFTT—Global Food Safety Initiative: Food Fraud Think Tank
[d]Gray market—a market employing irregular but not illegal methods; theft, something stolen
[e]Diversion/parallel trade—the act or an instance of diverting straying from a course, activity, or use
Comment: This table is used as the types of fraud list and definitions in the GFSI Food Fraud Technical Document published in 2018. That report is the reference used for GFSI compliance

Sidebar: Types of Fraud Defined—Why Include Diversion and Simulations

The book *Counterfeiting Exposed* (2003) was a very important influence on my thinking because it is one of the most thorough and practical presentations of the problem and how to address it (Hopkins et al. 2003). The authors were very realistic—based on experience—in the role of government, the role of consumers, and what really can be done to reduce counterfeiting. They expanded from "counterfeiting is bad" and "what wasn't being done" to a presentation of fundamental concepts and a practitioner-based focus on implementing strategies. They specifically refer to "detect, deter, and control" which our MSU research evolved from "control" to "prevention." Also, they build upon the general concept of "no product is too cheap to counterfeit" and "if you can make it, they can fake it"—which for me evolved to a focus on the overall fraud opportunity.

An important foundational concept covered in the book was addressing the types of counterfeiting which our MSU research evolved to more broadly cover all the types of fraud. If product fraud is occurring, then there is a supply chain lack of control that could be a vulnerability for counterfeits to enter the market. They define:

- **Counterfeiting:** "the knowing duplication of a product by a party who wishes to usurp the brand or trademark of another" (Hopkins et al. 2003).
- **Simulation or Copycat:** "By contrast [and different than counterfeiting], is a copy of a product in form or substance with no attempt to actually duplicate the brand name" (Hopkins et al. 2003). Though the trademarked name is not used, this may be a violation of other intellectual property laws such as "trade dress" or "patent." "They are attempting to profit from association with the brand and may face other legal challenges." The presence of simulations signals an unmet market need and is a possible indicator that counterfeits may also be in this supply chain.
- **Overruns/production-overruns:** "Although often of identical quality to the legitimate product, are produced in violation of the brand owners' rights" (Hopkins et al. 2003). This is conducted by an authorized and legitimate co-manufacturer or partner who produces the product without the authorization of the right holder. The right holder does not get paid for the sales of this branded product. This is sometimes referred to as a "ghost shift" or "fourth shift"—there are three, 8-hour shifts per day. In some cases, the "unauthorized overrun" could be identical or a clone of the genuine product. If this is food, then it would be considered illegal under the "Adulterated Foods" section of the US Food, Drug, and Cosmetics Act because it was manufactured outside the control of the company. Other times the substandard product is reclaimed (not properly disposed of) and sold. As with the other definitions, the presence of overruns signals a lack of control of supply chains—or in this case the production—which is a

possible indicator that counterfeit products may be in this supply chain. Also, from the US Department of Justice guidance for prosecuting IP cases, "As with overrun goods, the marks on gray market goods are placed there with the mark-holder's authorization. What the mark-holder has not authorized is the sale of those foreign goods within the United States" (DOJ 2013).

Regarding overruns, a unique situation with designer apparel is that often the brand name is trademarked, but the design or patent is not. Thus, a contract manufacturer of a designer brand leather jacket could legally sell the exact same jacket if the brand label was not used. There may be commercial agreements that control these sales, but without the design or patent, then this would not be illegal and not a criminal act.

- **Gray Market or Diversion (or Parallel Trade):** "When products which are shipped into specific distribution channels are shipped out of those channels into others, often in violation of distribution or sales contracts" (Hopkins et al. 2003). Also see US Department of Justice guidance for prosecuting IP cases, section on "Authorized-Use Defense: Gray Market Goods." From Black's Law Dictionary, "A market in which the seller uses legal but sometimes unethical methods to avoid a manufacturer's distribution chain and thereby sell goods (especially imported goods) at prices lower than those envisions by the manufacturer. See Parallel Imports."
- **Illegal Diversion—First-Sale Doctrine**: They clarify legal or illegal diversion based on the first-sale doctrine which defined who legally controls the product after a legitimate first sale, based on the first-sale doctrine. This would be illegal after a legitimate first sale, and this would only if the export to a specific country is illegal and if the sales in the new country would be a violation of a different law, for example, sales of controlled substances of some medicines that are not approved in a country or their distribution is tightly controlled. A violation, such as commercial geographic distribution agreements, could be subject to a civil lawsuit but not prosecution in a criminal proceeding.
- **Black Market** (Black's Law): An illegal market for goods that are controlled or prohibited by the government, such as the underground market for prescription drugs. Also Shadow Economy or Underground Economy.
- **Parallel Imports** (Black's Law): Goods bearing valid trademarks that are manufactured abroad and imported into the US to compete with domestically manufactured goods bearing the same valid trademarks. Domestic parties commonly complain that parallel imports compete unfairly in the US market. But US trademark law does not prohibit the sale of most parallel imports. Also termed "gray-market goods." See "Gray Market" under "Market."

(continued)

- **Parallel Imports/Parallel Trade** (WTO): "When a product made legally (i.e., not pirated) abroad is imported without the permission of the intellectual property right-holder (e.g., the trademark or patent owner). Some countries allow this; others do not."
- **Shadow Economy** (Black's Law): Collectively, the unregistered economic activities that contribute to a country's gross national product. A shadow economy may involve legal or illegal production of goods and services, including gambling, prostitution, and drug-dealing, as well as barter transactions and unreported incomes. Also termed "black economy," "black market," and "underground economy."

Regarding diversion, the activity signifies a supply chain may be "porous" which is a possible indicator that counterfeit product may be in this supply chain. "Furthermore, global supply chains have become increasingly fragmented and indirect. It is therefore relativity easy to blend fake product with the legitimate product in the gray market or to find unauthorized dealers over the internet" (Hopkins et al. 2003). A concerning situation since this lack of transparency can create an opportunity for stolen goods to reenter the legitimate supply chain, products "decoded" with their traceability or authenticity features removed or others. Also "criminals also use [parallel trade] as a channel for mixing of real with fakes and for the importation of counterfeits" (Hopkins et al. 2003).

- **Illegal Diversion—Stolen, Decoded, Substandard:** these products are illegal for those reasons such as stolen goods represented as legal, products "decoded" with their traceability or authenticity features removed, or products that may be substandard based on local laws or regulations.

The book *Counterfeiting Exposed* presented a practical approach to prevention and presented an obvious need to focus on the criminal motivation for any and all types of fraud. This book helped the research expand from counterfeiting to all types of fraud.

Sidebar: Expanded Review of the First-Sale Doctrine—The Right to Resell Legitimately Purchased Products

From the US Department of Justice's Criminal Resource Manual, CRM 1500–1999, Criminal Resource Manual 1801–1899 (DOJ 2019):

- 1854. COPYRIGHT INFRINGEMENT—FIRST-SALE DOCTRINE
- "Few issues have created greater confusion in criminal copyright prosecutions than the 'first sale doctrine.' The doctrine is one of the specific statutory restrictions which Congress has placed on the exclusive rights of copyright owners. Criminal defendants frequently resist prosecution by

claiming that they believed that the works they were selling had been the subject of a legitimate first sale. Moreover, several criminal copyright convictions have been overturned because of inadequacies in the government's proof on this issue."

- "'The first sale doctrine,' codified at 17 U.S.C. § 109, provides that an individual who knowingly purchases a copy of a copyrighted work from the copyright holder receives the right to sell, display or otherwise dispose of that particular copy, notwithstanding the interests of the copyright owner. The right to distribute ends, however, once the owner has sold that particular copy."

The first-sale Doctrine is related to the exhaustion rule:

- **Exhaustion** (sales exhaustion rule) (WTO): In intellectual property protection, the principle that once a product has been sold on a market, the intellectual property owner no longer has any rights over it. (A debate among WTO member governments is whether this applies to products put on the market under compulsory licenses.) Countries' laws vary as to whether the right continues to be exhausted if the product is imported from one market into another, which affects the owner's rights over trade in the protected product. See also parallel imports or first-sale doctrine (WTO 1994).

For food fraud prevention, there are a couple of situations where this may apply. First is selling product outside an authorized distribution area. For example, consider a distributor who is contracted to be the authorized seller of your product in Michigan who decides to sell the product in Ohio. This act may be a violation of a contractual agreement, prosecutable in civil court, but may not be a violation of a specific criminal law. Second, a short-dated product (product near the expiration date) may be sold at a deep discount to an exporter for sale in another country. This would provide a benefit of receiving some revenue for that product before it would need to be destroyed and also to be sold in a faraway market that would not impact the local market price. Considering the first-sale doctrine, this is a legal sale of a genuine product so the buyer could legally resell that product to the first market. This would not be a violation of the criminal law but could be subject to a contractual violation and possibly prosecuted under civil law. The best option is to have a strong contractual agreement and understanding of where this product is allowed to be sold. There is another example of a product where the labeling or recipe is legal in one country and not another. The sale of the diverted product into an illegal market would not be a specific violation of the first sale doctrine but would be illegal under possibly many other laws such as smuggling or food labeling.

Sidebar: The Special Problem of Overruns

Several of the types of food fraud may seem to be determined by casual or unsophisticated decisions, but there is often case law to support the inclusion. For example, product overruns are defined in US law and include guidance for prosecutors (DOJ 2013). For example, here is text from a legal defense:

- "**Overrun**: goods or services, that is, goods or services that an otherwise authorized manufacturer or producer makes and sells on the side without the mark-holder or licensor's knowledge or approval."

It is important to note that some of the overruns are not considered technically "counterfeits." "If a licensee manufactures overruns during the course of the valid license, the marks on those goods will remain non-counterfeit for purposes of this act."

Examples of the types of overruns are:

- **Overproduction: "**For instance, consider a trademark licensee who is authorized to make 500,000 umbrellas bearing the licensor's trademark but who manufactures without authorization an additional 500,000 umbrellas bearing that mark during the course of the license. *Joint Statement*, 130 Cong. Rec. 31,676 (1984). Because the trademark owner in this situation can protect himself through "contractual and other civil remedies," Congress felt that it was "inappropriate to criminalize such practices." *Id.* Thus, "[if] a licensee manufactures overruns during the course of the valid license, the marks on those goods will remain non-counterfeit for purposes of this act." *Id*.
- **Expanded Product Line:** "a licensee produces a type of goods in connection with which he or she was not authorized to use the trademark in question." … For example, "if a licensee is authorized to produce 'Zephyr' trench coats, but without permission manufactures 'Zephyr' wallets, the overrun exception would not apply." In this example, the licensee could be prosecuted for producing the wallets only if the 'Zephyr' mark was registered for use on wallets as well as trench coats."
- **Production After Authorization Ends:** "limited to goods or services for which authorization existed "during the *entire* period of production or manufacture."
- **Sales of Rejected or Substandard Production:** "The use of a licensee's rejected irregular goods."

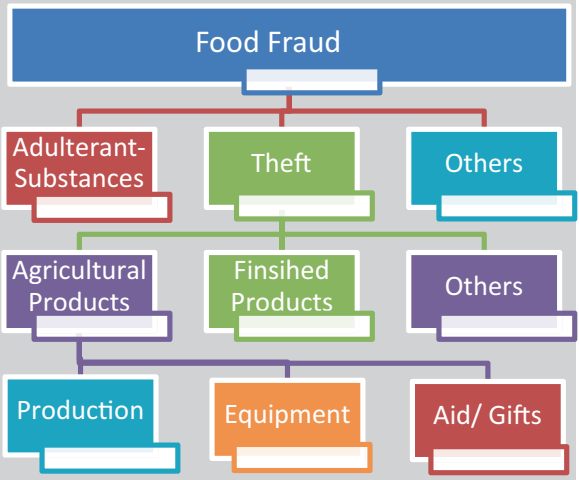

Fig. 1.3 Praedial larceny hierarchy from food fraud to theft to theft of agricultural products including the types of products

Sidebar: FAO and Praedial Larceny Including Agricultural Theft

The food fraud prevention concepts apply to a wide range of food supply problems, including theft, which is one of the types of food fraud. Within food fraud/theft, there are many different "hot products" and "hot spots" that can efficiently and effectively adapt the general prevention concepts to specific problems (Lam and Spink 2018; Spink 2019)—in this case to a very specific problem of the theft of agricultural products and related production and processing equipment (Fig. 1.3).

While possibly not a well-known term or widely understood problem, praedial larceny has been identified as one of the most critical food security and criminal activities in many regions of the world. The cost and public health harm are also probably vastly underestimated around the world and in the USA because the many types of incidents are reported under a wide range of laws such as motor vehicle theft, grand larceny, smuggling, food adulteration, food misbranding, or others (FAO 2013).

The Food and Agriculture Organization (FAO) of the United Nations has had an ongoing focus on addressing the challenges of praedial larceny or what is also categorized as a wide range of agriculture-related thefts (FAO 2013):

- **Praedial** (\'prēdēəl\): Being or made up of land or immovable property or the profits therefrom (Roman law) (Black's 2014).
- **Larceny: "**The unlawful taking of property other than a motor vehicle from the possession of another, by stealth, without force or deceit. Includes pocket picking, non-forcible purse snatching, shoplifting, and thefts from motor vehicles. Excludes receiving and/or reselling stolen property (fencing) and thefts through fraud or deceit" (US DOJ 2017).

(continued)

- **Praedial Larceny**: The theft of agriculture products […] to include the theft of agricultural equipment, agriculture inputs and secondary products such as feed and fodder (FAO 2013).

From the FAO Issue Brief on Praedial Larceny in the Caribbean (FAO 2013):

- ***The most extensive among all crimes committed in the [Caribbean] sub-region*** in terms of the number of persons and families affected.
- ***98% of all producers surveyed have experienced this type of loss.***
- ***The single greatest disincentive to investment in the sector.***
- Estimates are that ***18% of the value of farm output regionally*** is taken by thieves.

The FAO report differentiated between a thief who steals product for their own consumption and criminals who steal to resell or trade the products. It is documented that, in some cases, criminals or gangs convert the livestock into cash to buy drugs or guns which creates a national security threat. There is also ongoing research on the different types of victims, including the farmers, processors, producers, and retailers. A specific type of Praedial Larceny or Agricultural Theft (PLAT) includes losses of food aid and humanitarian aid which could include food or related food security contributions such as seeds, fertilizer, feed, agricultural equipment, or even products such as gifts of animals used for breeding or food production.

So, the victims are identified, and the consequence or result of the fraud act is well documented. A next step is to understand how this problem fits into other broader problems and overall global priority-setting. When the agricultural products are stolen, it reduces the food available for the producer to sell or the aid organization to distribute. The ultimate impact is that food fraud—and Praedial Larceny or Agricultural Theft—negatively impacts food security.

While the impact on food security may seem intuitive at first, it is important to note that the ultimate goal of food security is to create and sustain continuous food production and prosperity. Specifically, the food security priorities for the WHO include (emphasis added):

From the World Health Organization—Goals for Food Security:

- Eradicating poverty and promoting prosperity for a changing world prioritizes the following goals (WHO 2009):
  - Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture
  - Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

For food fraud prevention, there are clear applications deep into problems that can have broad impacts beyond the immediate victim to entire markets such as increasing global food security.

Definitions of Food Risks: Food Quality Food Safety, Food Fraud, and Food Defense

To consider food fraud in relation to the bigger picture, the other food risk types are defined (Spink and Moyer 2011a, b):

- *Food Quality*: Product meets the specification. This is an unintentional act with no intent to harm.
  - *Food Quality (CODEX):* "Quality includes all the attributes that influence a product's value to the consumer. This includes negative attributes such as spoilage, contamination with filth, discoloration, off-odours and positive attributes such as the origin, colour, flavour, texture and processing method of the food" (CODEX 2014). Note: it is interesting that the 2014 Codex definition includes "the origin" and "processing method"—thus, a fraudulent act could violate that part of the definition and define a lack of quality.
  - *Quality Assurance (CODEX CCFICS):* "all those planned and systematic actions necessary to provide adequate confidence that a product or service will satisfy given requirements for quality (ISO-8402 Quality – Vocabulary)."
- *Food Safety*: Product causes a health hazard. This is an unintentional act with a health hazard.
  - *Food Safety (Codex):* "The assurance that food will not cause harm to the consumer when prepared and/or eaten according to its intended use" (CODEX 2014).
- *Food Fraud* (basic short version): Illegal deception for economic gain using food.
- *Food Defense*: An intentional act with the intent to harm as defined in terms of psychological terror, economic harm, or a public health threat.
  - *Food Defense (FSMA-IA):* The US Food Safety Modernization Act includes an Intentional Adulteration Final Rule that narrows a focus of Food Defense to "wide-scale human health harms" (FDA 2016). When addressing food defense, it is *critical* to state the definition and scope of the project to avoid confusion related to regulatory or certification compliance.

It is understood that food fraud is a description of the unacceptable act, not the prevention activity. Over time, it seemed that there was no more efficient term to use. Of course, food safety is protecting the food from health harms, food defense is to protect the food from an intentional act intended to harm, and so food fraud prevention is protecting the food from fraudulent acts.

The food risk definitions and examples are expanded (Table 1.3) (Spink and Moyer 2011a, b):

Table 1.3 Types of food risks with examples, the cause and motivation, the effect, the public health risk type, and secondary effect

Discipline risk type	Example	Cause and motivation	Effect	Public health risk type	Secondary effect
Food quality	Accidental bruising of fruit	Mishandling	Unsalable product or possible additional contamination with *E. coli* O157:H7	None or food safety	Reduced brand equity or food safety incident
Food fraud	Intentional adulteration of milk with melamine	Increased margin	Toxic poisonings	Food safety	Public fear and possibly lower prices industry-wide
Food safety	Unintentional contamination of raw vegetables with *E. coli* O157:H7	Limited field protection and control during harvesting and processing	Illnesses and/or deaths	Food safety	Damaged industry, product recall expense, and public fear
Food defense	Intentional contamination of ground beef with nicotine	Revenge intent against the store/manager through injury to consumers	Nonlethal poisonings	Food defense	Adulterated product, damaged industry, product recall expense, and public fear

Adapted from Spink and Moyer (2011a, b)

Sidebar: Common Dictionary Definitions of Food Fraud-Related Terms
The product fraud, product anti-counterfeiting, and food fraud literature and application are rapidly changing. There are many terms that have been—or are—using common practice but possibly not based on formal review or intent. Several dictionary definitions are noted here (Merriam-Webster 2004) Webster's):

- **Counterfeit**: "To copy, with the intent to deceive" and "made in imitation of the genuine so as to deceive"
- **Diversion**: "A turning aside from a course, activity, or use"
- **Simulation**: "1: The act or process of simulating 2: an object that is not genuine 3: imitation by one system or process of the way in which another system or process works"—"simulate: to give or create the effect or appearance of"
- **Tamper:** "1: to carry on underhand negotiations (as by bribery) < ~with a witness>2: to interfere so as to weaken or change for the worse <~ with a document>3: to try foolish or dangerous experiments"
- **Knockoff:** "noun: a copy or imitation of someone or something popular"

- **Knock off:** "verb: 1 to stop doing something 2: to do quickly, or carelessly"
- **Replica:** "noun 1: an exact reproduction (as of a painting) executed by the original artist 2: a copy exact in all details: duplicate"

Definition of Contaminant and Contamination

Before moving on, to cover the related topics, we will review contaminants and contamination. Adulterant/adulteration and contaminant/contamination are closely related terms that are often incorrectly interchanged. The most official and direct definition of a contaminant is by the *Codex Alimentarius* (CODEX) (CODEX 2014):

- *Contaminant* (Codex): Contaminant (CODEX, Procedural Manual). *Codex Alimentarius* defines a contaminant as follows: "Any substance not intentionally added to food, which is present in such food as a result of the production (including operations carried out in crop husbandry, animal husbandry and veterinary medicine), manufacture, processing, preparation, treatment, packing, packaging, transport or holding of such food or as a result of environmental contamination. The term does not include insect fragments, rodent hairs, and other extraneous matter" (CODEX 1995).

CODEX does not define an acceptable amount of the contaminant only that it is "any" "substance" that is "not intentionally" "added." CODEX does not define deliberate contamination, but a definition can be inferred. An adulterant is not defined so the definition of the term "adulteration" cannot be inferred.

Definition of Food Counterfeiting and Food Crime

The term "crime" and "counterfeiting" has been applied to food. Both are applicable in specific situations. When there is a shift of focus from the "effect" to the "cause"—and to build on our 2005–2012 research focus on IP violations and counterfeiting—we first used the term "food counterfeiting."

There is a challenge of using the term "counterfeit" because although the dictionary definition applies to deception and fraud, there is an insinuation that the term applies to only intellectual property rights. On several occasions, food industry managers stated that they didn't have a "counterfeit" problem, but they did have broader "fraud" problems. Food fraud was a more widely applicable and understood term than food counterfeiting. This is a term emphasized in the UK and in the UK DEFRA Elliott Review.

Another related concept is "food crime." There are two definitions (Manning and Soon 2016; van Ruth et al. 2017):

- *Food Crime* (UK DEFRA): All types of food fraud that is conducted on a large scale (NFCU 2017). Long Definition: "Dishonesty relating to the production or supply of food that is either complex or likely to be seriously detrimental to consumers, businesses or the overall public interest. Food fraud becomes a food

crime when the scale and potential impact of the activity is considered to be serious. This might mean that the criminal activity has cross-regional, national or international reach, that there is a significant risk to public safety, or that there is a substantial financial loss to consumers or businesses. Clearly, the full extent and impact of food criminality may not be immediately apparent when information is first received" (NFCU 2017).

- *Food Crime* (general): Incidents involving food that is a violation of a criminal statute. Long definition: None.

The food crime term is confusing for two reasons: (1) crimes are sometimes defined only as a violation of a criminal statute, and some food fraud is outside this scope, and (2) any crime using food could include activities beyond the economic motivation to the scope of food defense (intent to harm) or food quality (legal violation or criminal negligence).

Every crime may be a fraud, but every fraud may be a crime. In most cases, the term food crime does apply. That said, food crime is a term that is understandable to many. The first goal is clear communication of the message. If food crime is the term that gets attention, then use the term but be clear about the definition and scope.

Key Learning Objective 3: The Food Risk Matrix—Food Quality, Food Safety, Food Fraud, and Food Defense

This section reviews the relationship between the food risks including the presentation in the Food Risk Matrix. The relationship of these food risks, in addition to a wider set of related terms, helps clarify the wide range of prevention activities. To understand the currently applied definitions, it is helpful to examine the origin of several of the key terms.

The Key Learning Objectives of this section are

- (1) Review of the Food Risk Matrix
- (2) Consideration of the relationship of other food fraud terms
- (3) Then a consideration of the foundation of related terms such as adulterated, misbranded, and economically motivated adulteration

The Food Risk Matrix

One way to review and organize all food risks is by using the Food Risk Matrix (Fig. 1.4) (Spink and Moyer 2011a, b). The Food Risk Matrix is a way to review the food risks and how they relate to each other. To start the definitions are (Spink and Moyer 2011a, b). The Food Risk Matrix was developed to focus on prevention which is the cause—not the effect—of an incident. This is an important concept because it covers all types of food risks that are the responsibility of an entire enterprise which could be a company or a country.

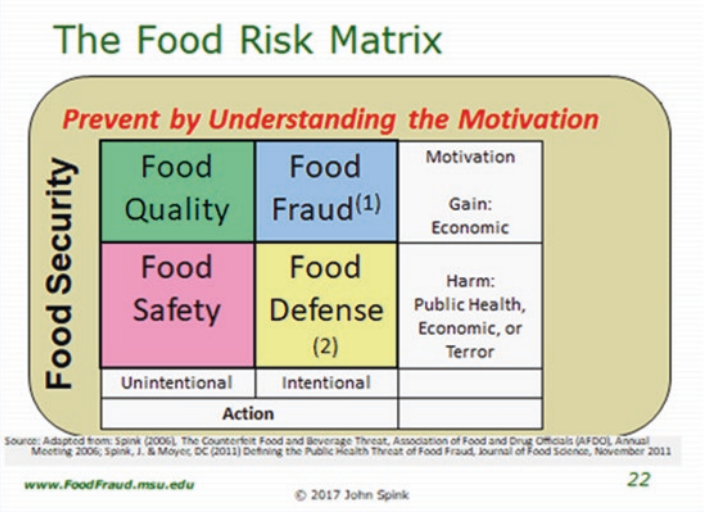

Fig. 1.4 Food Risk Matrix. (Copyright Permission Granted) (Spink 2007; Spink and Moyer 2011a, b)

Definitions of Additional Related Terms

There are several additional related terms that will be reviewed here. One separate concept that is often confused is food defense and food security. *Food defense* is protection from an attack with the intent to harm, and food security is the continuous supply of enough food. As defined by the World Health Organization (WHO) and widely adopted, it is to ensure the supply of food, not protecting food from attack.

- ***Food Security*** (WHO): "…exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life. Household food security is the application of this concept to the family level, with individuals within households as the focus of concern" (WHO 2009).

In addition, other food fraud-related terms are included. Currently, the definitions of both terms are being evaluated and edited by groups including *Codex Alimentarius*. The definition and reference will probably change in the future.

- *Food Authenticity* (Elliott Review): Food is what it says it is (DEFRA 2014). The long definition "… is about ensuring that food offered for sale or sold is of the nature, substance, and quality expected by the purchaser (Section 14 Food Safety Act 1990). Authenticity can be a particular issue for faith groups or consumers with particular food preferences who do not want to purchase products containing certain ingredients" (DEFRA 2014).
- *Food Integrity* (EC, FIP): The product is of the specification defined such as quality and label claims (EU FIP 2017). "The long definition is "the state of being whole, entire, or undiminished or in perfect condition." Providing assurance to consumers and other stakeholders about the safety, authenticity, and quality of

European food (integrity) is of prime importance in adding value to the European Agri-food economy. The integrity of European foods is under constant threat from fraudulently labeled imitations that try to exploit that added value" (EU FIP 2017).

The final definition is for the term food protection. There have been several informal definitions that are based on the previous food defense definition of protecting against intentional acts, and some others include protection from any type of harm including food safety incidents.

- *Food Protection* (FDA 2007): Address food safety and food defense (including food fraud/ EMA) (FDA 2007) and in (Petrova Dickenson and Spink 2019). A long definition from FDA is: "A Food Protection Plan (the Plan) that addresses both food safety and food defense for domestic and imported products. … Address both unintentional and deliberate contamination" (FDA 2007).

Together, these are all terms related to food fraud as well as all food risks.

Food Risk Terminology Relationship Matrix

To provide clarity on the relationship between the terms, the figure was created (Fig. 1.5).

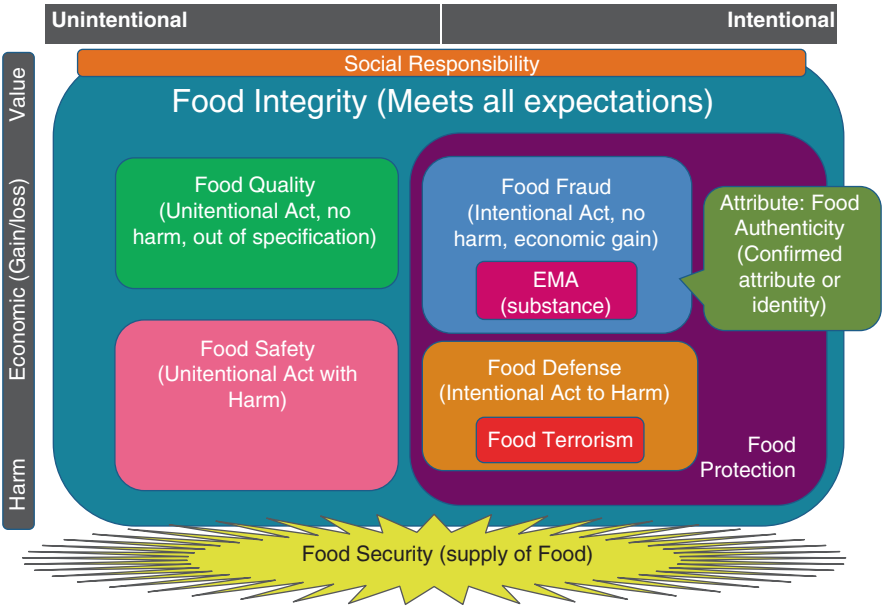

Fig. 1.5 Hierarchy and relationship of food fraud-related terms with the addition of food protection, food integrity, food authenticity, social responsibility, and food security

Sidebar: The Importance of Clear Definitions: The Four Definitions of "Food Quality" (MSU FFI 2018)

Title: The Importance of Clear Definitions: The Four Definitions of "Food Quality"

By John Spink • February 24, 2014 • Blog

"Argh… are those academics crazy for being such sticklers about definitions?" Not at all! So far — with scholarly articles to quote and reference — we're all creating a harmonized starting point for food fraud prevention the important work is to just start defining and clarifying even the most basic terms. We all need to stay focused because the laws, regulations, and industry certifications are just now being finalized.

Our definition of food fraud is getting quite a bit of attention, being quoted in the many US and global regulations or reports. As we're all developing our responses to FDA's formal request for comments on the Food Safety Modernization Act (FSMA), another concept that's important to review is "food quality."

While we have presented food quality in presentations or in our MOOC, we haven't directly addressed it in a publication. This discussion is essential to demonstrate why accurate definitions are so critical… moreover, how we can get on the wrong track with inaccurate ones.

When we were researching our NCFPD backgrounder on Food Fraud recently (Spink and Moyer 2011a, b), we found these varying definitions of "food quality" or "Quality Food":

- Public Health Professional: doesn't make people sick
- Food Manufacturing Manager: product attributes that lead to consistent end product and manufacturing operations
- Food Standards and Certification Leader: meets the defined specifications such as viscosity, density, color, texture, etc.
- Consumer: a high quality or premium

While you may not agree on every aspect of the definitions, an understanding of the different assumptions is essential. If the four stakeholders in those bullet points were working together on a project, without clear definitions, they could all start arguing about project details that might actually be the same. Right or wrong, different groups can have different understandings of the meaning of what seems to be the most rudimentary of terms. This challenge becomes even more of an issue when translating and interpreting between languages and alphabets. On a current food fraud prevention project involving the US, Russia, and Korea we were taking a proactive approach of first creating a background document with the definitions – translated into each language. We're also engaging linguistics scholars to help study the process of translating between languages. As with other food fraud research, this is helping establish a very firm foundation for future work.

(continued)

While the world is developing the first food fraud prevention laws, regulations, and industry standards, it is critical that we continue to focus on defining and explaining the foundational concepts. This is important whether it is for FSMA Intentional Adulteration, the European Parliament/ European Commission/ European Union draft regulation on food fraud, the UK Elliott Review of food fraud, the Global Food Safety Initiative (GFSI) guidance document, or the International Standards Organization activities.

So, pay attention, engage, and stay involved when these laws, regulations, and industry standards are being defined. If we all engage early and often, we have a better chance of all getting on the same page and reducing confusion. Hopefully, these efforts help to support the implementation of efficient and effective countermeasures and control systems. We will continue to present those key reports in this blog series. Stay tuned. MSU-FFI.

Adulterant, Adulteration, and Adulterated Foods

A source of confusion has been the use of the term economically motivated adulteration which is abbreviated as "EMA." Initially, adulteration was the subject of an 1820 book by Frederick Accum on *A Treatise on Adulteration of Food and Culinary Poisons* (Accum 1820) (for more on Accum, see later section). The key challenges from Accum's work are (1) no definition of adulteration and (2) no definition of adulterant. The book focuses on methods to detect "counterfeiting and adulteration" of either substituted or lower quality substances. Later the term "economic adulteration" was introduced seemingly from the 1996 US Government Accountability Office (GAO) report on "fruit juice adulteration." This report stated, "Although these types of adulteration provide an economic advantage (and are therefore referred to as economic adulteration), they pose little threat to the public's health and safety" (GAO 1995). That report repeatedly emphasized there was "little threat to the public's health." To note, a 2018 internet keyword search using Google did not find any mentions of "economic adulteration" before the GAO report published on November 5, 1995. Another search in 2018 on "economically motivated adulteration" did not find any results for that term before 2000.

From the *Federal Register* published meeting invitation (emphasis added),[3] expanding on the FDA EMA definition quoted above, FDA did not exactly define adulteration or adulterant:

> The Food and Drug Administration (FDA) is announcing a public meeting pertaining to economically motivated adulteration (EMA). The purpose of the meeting is to stimulate and focus a discussion about ways in which the food (including dietary supplements and animal food), drug, medical device, and cosmetic industries, regulatory agencies, and other parties

[3] Note: See the glossary for re-specific and formally published definitions of key words such as interested parties, organization, management, top management, management system, documented/ documented information, test, exercise, and others.]

> can better predict and prevent economically motivated adulteration with a focus on situations that pose the greatest public health risk. FDA invites interested individuals, organizations, and other stakeholders, including industry representatives, to present information pertaining to predicting and preventing EMA of food (including dietary supplements and animal food), drugs, medical devices, and cosmetics. The agency also requests interested parties to submit comments on this issue to the public docket.

Remember, as quoted earlier in this document, the FDA Public Meeting on Economically Motivated Adulteration Invitation was published officially and publically in the *Federal Register* and included a "working definition" of EMA as (emphasis added):

> Fraudulent, intentional substitution or addition of a substance in a product for the purpose of increasing the apparent value of the product or reducing the cost of its production, i.e., for economic gain. (FDA 2009)

It is important to note that although this is a formal publication, it is a meeting invitation and not a researched publication or a final agency conclusion. FDA has continued to use this as a working definition. FDA has had no reason or requirement to review or update this term.

An especially confusing aspect of this working definition of EMA is that the "adulteration" term is defined in conflict with the "Adulterated Foods" Section of the US Food Drug and Cosmetics Act (FDCA) of 1938 (FDA 2015). The FDCA defines "Adulterated Foods" as anything that compromises the product including a genuine product that spoils and a product where the Good Manufacturing Practices cannot be confirmed such as stolen goods that have been outside the control of the owner. The FDCA has a separate section on "Misbranded Foods" which refers to labeling and claims.

The confusion is that the working definition of economically motivated adulteration requires a "substance"—or adulterant—but the FDCA "Adulterated Foods" section does not. (Consider the challenge of trying to explain to a foreign language translator that an "adulterated product" is not necessarily required to include an "adulterant.")

Later the US Food Safety Modernization Act (FSMA) of 2011 added more confusion—but maybe some clarity if the ambiguity is considered intentional text and interpreted literally—in the Preventive Controls (FSMA-PC) Final Rule. The original FSMA law does not mention or cite the term EMA (so economically motivated adulteration is not a term that the FDA legally must use). FSMA-PC refers to economically motivated adulteration but not "EMA" and does not include any mention to the working definition of EMA or the previous public meeting (there are no mentions of "EMA" and 33 uses of the phrase "economically motivated adulteration"). Later the FSMA-PC for Human Foods Qualified Individual training (PCHF-QI) also does not define the term or use "EMA" while introducing new terms including "economically motivated hazard" and "economically motivated food safety hazard." There would have been no confusion if either of those two terms was used in the 2009 public meeting.

The result is that globally the problem has been referred to as food fraud. Occasionally economically motivated adulteration is still used to refer to food fraud that occurs with and adulterant-substance. The food fraud term is short and easy to say as well as correlates with the related terms of food quality, food safety, and food defense.

Due to all this confusion, when even referring to a substance that was intentionally added for economic gain, there has been a trend to shift from EMA or adulteration to "adulterant-substance." Adulterant-substance is used in this research and more often by other scholars.

Sidebar: Regulatory Definition of "Adulterated Foods"—A US Example
The general concept of an "adulterant" and "adulteration" should not be confused with the US-centric "Adulterated Foods" concept. In the Food and Drug Cosmetics Act of 1938 (FDCA), adulteration is defined and explained in a section on Adulterated Food (21 USC §342, 2007) which is separate from misbranding, which is defined in a separate "Misbranded Foods" section (21 USC §343, 2004). Reviews of this FDCA section usually focus on the health hazard and not the violations for lack of control or the ability to verify that Good Manufacturing Practices have been attained and maintained.

Details of the sections on "Adulterated Food" and "Misbranded Food" are presented with a listing of each subsection and details needed. For a product to be a regulatory violation of "Adulterated Food" section, there must be an actual hazard which is not required and just a concern that "whereby it may have become contaminated." The FDCA definition of "Adulterated Foods" is (only applicable sections are included) (FDA 2015):

- **'§ 342. Adulterated food**
- A food shall be deemed to be adulterated—
  - '(a) Poisonous, insanitary, etc., ingredients
- '(1) If it bears or contains any poisonous or deleterious substance which may render it injurious to health.
- '(2) if it bears or contains any added poisonous or added deleterious substance (other than a substance that is a pesticide chemical residue in or on a raw agricultural commodity or processed food, a food additive, a color additive, or a new animal drug) that is unsafe…
- '(3) if it consists in whole or in part of any filthy, putrid, or decomposed substance, or if it is otherwise unfit for food; …
- '(4) if it has been prepared, packed, or held under insanitary conditions whereby it may have become contaminated with filth, or whereby it may have been rendered injurious to health; …
- '(5) if it is, in whole or in part, the product of a diseased animal or of an animal which has died otherwise than by slaughter; or

- ‘(6) if its container is composed, in whole or in part, of any poisonous or deleterious substance which may render the contents injurious to health; …
- ‘(7) if it has been intentionally subjected to radiation, …
    - ‘(b) Absence, substitution, or addition of constituents
- ‘<(1) If any valuable constituent has been in whole or in part omitted or abstracted therefrom;
- ‘<(3) if damage or inferiority has been concealed in any manner; or
- ‘<(4) if any substance has been added thereto or mixed or packed therewith so as to increase its bulk or weight, or reduce its quality or strength, or make it appear better or of greater value than it is.
    - ‘(c) Color additives
- ‘< If it is, or it bears or contains, a color additive which is unsafe within the meaning of section 379e(a) of this title.
    - ‘(d) Confectionery containing alcohol or nonnutritive substance
    - ‘(e) Oleomargarine (or margarine or butter) containing filthy, putrid, etc., matter
    - ‘(f) Dietary supplement or ingredient: safety (unsafe or unapproved)
    - ‘(g) Dietary supplement: manufacturing practices (same as for “(a)”)
    - ‘(h) Reoffer of food previously denied admission
- ‘< If it is an article of food imported or offered for import into the United States and the article of food has previously been refused admission under section 381(a) of this title, …
    - ‘(i) Noncompliance with sanitary transportation practices

There are also often sections applying to specific products such as infant formula:

- **‘§ 350a. Infant formulas**
- ‘(a) Adulteration
- An infant formula, including an infant formula powder, shall be deemed to be adulterated if—
    - ‘(1) such infant formula does not provide nutrients as required by subsection (i) of this section,
    - ‘(2) such infant formula does not meet the quality factor requirements prescribed by the Secretary under subsection (b)(1) of this section, or
    - ‘(3) the processing of such infant formula is not in compliance with the Good Manufacturing Practices and the quality control procedures prescribed by the Secretary under subsection (b)(2) of this section.

(continued)

The FDCA is focused on public health threats, and the definitions define the *effect not* the *cause*. For example, a genuine product that has spoiled would be defined by the FDCA as an "Adulterated Food," but clearly there is not "adulteration"—at least not in line with the intentional adulteration or economically motivated adulteration concepts.

Thus, when looking at the definitions, a product that meets the definition of an "Adulterated Food" might *not* require an adulterant.

Sidebar: Regulatory Definition of "Misbranded Foods"—A US Example
Since the terms adulteration and misbranding are often mentioned together—including in the Food Safety Modernization Act—it is essential to review the FD&C definition of "misbranding" (FDA 2015):

§ 343. Misbranded food

A food shall be deemed to be misbranded—

- '(a) False or misleading label
  - < If (1) its labeling is false or misleading in any particular, or (2) in the case of a food to which section 350 of this title applies, its advertising is false or misleading in a material respect or its labeling is in violation of section 350(b)(2) of this title.
- '(b) Offer for sale under another name (of another food)
- '(c) Imitation of another food
  - < If it is an imitation of another food, unless its label bears, in type of uniform size and prominence, the word "imitation" and, immediately thereafter, the name of the food imitated.
- '(d) Misleading container
  - If its container is so made, formed, or filled as to be misleading.
- '(e) Package form
  - If in package form unless it bears a label containing
  - <(1) the name and place of business of the manufacturer, packer, or distributor; […]
  - <(2) an accurate statement of the quantity of the contents in terms of weight, measure, or numerical count, […]
- '(f) Prominence of information on label
- '(g) Representation as to definition and standard of identity
- '(h) Representation as to standards of quality and fill of container
- '(i) Label where no representation as to definition and standard of identity

  - Unless its label bears (1) the common or usual name of the food, if any there be, and (2) in case it is fabricated from two or more ingredients, the common or usual name of each such ingredient and if the food purports to be a beverage containing vegetable or fruit juice, a statement with appropriate prominence on the information panel of the total percentage of such fruit or vegetable juice contained in the food; …

- ‘(j) Representation for special dietary use
- ‘(k) Artificial flavoring, artificial coloring, or chemical preservatives
  - If it bears or contains any artificial flavoring, artificial coloring, or chemical preservative, unless it bears labeling stating that fact, except that to the extent that compliance with the requirements of this paragraph is impracticable,
- ‘(*l*) Pesticide chemicals on raw agricultural commodities
- <If it is a raw agricultural commodity which is the product of the soil, bearing or containing a pesticide chemical applied after harvest, unless the shipping container of such commodity bears labeling which declares the presence of such chemical in or on such commodity […]
- ‘(m) Color additives
- ‘(n) Packaging or labeling of drugs in violation of regulations
- ‘(q) Nutrition information
  - <label or labeling bears nutrition information that provides— (A)(i) the serving size which is an amount customarily consumed and which is expressed in a common household measure that is appropriate to the food, or
  - <(B) the number of servings or other units of measure per container,
  - <(C) the total number of calories—
  - <(D) the amount of the following nutrients: …
  - <(E) any vitamin, mineral, or other nutrient …
- ‘(r) Nutrition levels and health-related claims
- ‘(s) Dietary supplements (other requirements apply)
- ‘(t) Catfish
  - < If it purports to be or is represented as catfish, unless it is fish classified within the family Ictaluridae.
- ‘(u) Ginseng
  - <If it purports to be or is represented as ginseng unless it is an herb or herbal ingredient derived from a plant classified within the genus Panax.
- ‘(v) Failure to label; health threat

(continued)

Fig. 1.6 Food fraud as comprised of EMA and EMM

- '(w) Major food allergen labeling requirements
  - <(1) If it is not a raw agricultural commodity, and it is, or it contains an ingredient that bears or contains, a major food allergen, unless either—(A) the word "Contains", followed by the name of the food source …, '(B) the common or usual name of the major food allergen in the list of ingredients required …,
- '(x) Nonmajor food allergen labeling requirements
- '(y) Dietary supplements
- <If it is a dietary supplement that is marketed in the United States unless the label of such dietary supplement includes a domestic address or domestic phone number through which the responsible person is identified…"

Since "Adulterated Foods" are defined in regulations separately from the "misbranded foods," then if the word EMA is used, there should also be "economically motivated misbranding." Thus, considering the full scope of food fraud would cover economically motivated adulteration and also economically motivated misbranding.

Applying the section of this act regarding misbranding, then food fraud would be comprised of economically motivated adulteration and economically motivated misbranding (Fig. 1.6).

FDA Historical Foundation of the "Economically Motivated Adulteration" Term

The term "economically motivated adulteration" (EMA) was brought to the forefront when the US Food and Drug Administration (US FDA) announced a public meeting on EMA. The meeting addressed all FDA-regulated products including pharmaceuticals, medical devices, dietary supplements, and not just food. Led by Randall Lutter, the former Deputy Commissioner for Policy (currently Senior Science and Regulatory Advisor in the Immediate Office of the Commissioner reporting directly to FDA Commissioner Scott Gottlieb) 2009, the US FDA posted a *Federal Register* notice of a Public Meeting on EMA that was held in May 2009

(FDA 2009). While EMA has been a term mainly used since then by the food industry, the public meeting covered all FDA products. Specific examples of incidents published in the notice included (FDA 2009):

- **Melamine in pet food:** "In March 2007, FDA received reports of kidney failure among cats and dogs and a report that cats died during taste tests of certain brands of pet food. … Over 150 brands of pet food and 1000 products were voluntarily recalled by a number of companies."
- **Heparin in kidney dialysis medicine:** "In January 2008, FDA received reports of adverse reactions in pediatric dialysis patients … associated with heparin manufactured by Baxter Healthcare Corp. that was administered during the dialysis procedures."
  - Impact: "FDA's investigation ultimately identified almost 150 U.S. deaths occurring between January 1, 2007, and May 31, 2008, that appeared to be associated with the use of these heparin products."
- **Melamine in milk powder and infant formula:** "In September 2008, FDA issued a Health Information Advisory in response to reports of melamine-contaminated milk-based infant formula manufactured in China. Melamine was apparently added to diluted milk in order to increase measured nitrogen levels (indicators of protein content) and thereby inflate the apparent protein content found in the product."
  - Impact: "To date, official reports from the Chinese Ministry of Health state that nearly 300,000 Chinese infants were sickened by the contaminated infant formula, and that six infant deaths were likely due to the contamination."
- **Diethylene Glycol (DEG) in various medicine products:** "Adulteration of glycerin, an ingredient in cough syrup and other drugs, with diethylene glycol (DEG) has resulted in several mass poisonings around the world in the past two decades."
  - Impact: "In 1996, contaminated acetaminophen syrup was responsible for the deaths of more than 70 children in Haiti. In 2006, tainted cough syrup resulted in dozens of deaths in Panama. In Nigeria, between 2008 and 2009, more than 50 children died after ingesting contaminated teething syrup. Incidents of DEG contamination in these two decades have not resulted in any reported U.S. deaths or illnesses, but in 2007, foreign-made toothpaste contaminated with DEG was reported in the United States resulting in recalls and restriction on imports of suspect toothpaste."

The day-long FDA public meeting included presentations from many industry leaders from beyond the food industry. The presenters are listed here in order of the presentations on the meeting website (there were additional members listed on the agenda) (Table 1.4).

Table 1.4 Organizations and links to presentations at the FDA EMA public meeting in agenda order (Note: as listed on the FDA website in September 2018—additional presenters were listed on the agenda but not included in this set of links to the presentations) (FDA 2009)

Organizations who presented at the FDA EMA public meeting in order of presentation (as listed on the FDA website in September 2018—additional presenters were on the agenda)
1. Michigan State University (Defining Food Fraud & The Chemistry of the Crime. Presenter: John Spink, Ph.D., Associate Director Anti-Counterfeiting and Product Protection Program (A-CAPP), School of Criminal Justice)
2. US Pharmacopeia (Economically Motivated Adulteration, Roger L. Williams, M.D., Chief Executive Officer Chair, Council of Experts, US Pharmacopeia)
3. IPEC (International Pharmaceutical Excipients Council) (Efforts to Ensure Excipient Safety, Irwin Silverstein)
4. Amgen Incorporated (Economically Motivated Adulteration, Martin VanTrieste, Vice President Quality; Commercial Operations, Amgen)
5. National Fisheries Institute (Summary of Comments: Economically Motivated Adulteration, Lisa Weddig, National Fisheries Institute)
6. Science Personal Care Products Council (Suspected Economically Motivated Adulteration of FDA-Regulated Products, John E. Bailey, Executive Vice President– - Science Personal Care Products Council)
7. Natural Products Association (Economically Motivated Adulteration, Daniel Fabricant, Ph.D. Vice President, Scientific & Regulatory Affairs)
8. American Herbal Products Association (Simple Authentication Methods for Herbal Ingredient Integrity in the face of EMA, Steven Dentali, Ph.D., Chief Science Officer)
9. Council for Responsible Nutrition (Avoiding economic adulteration of dietary supplements: The need for ingredient supplier qualification guidelines, Andrew Shao, Ph.D., Vice President, Scientific & Regulatory Affairs)
10. ConsumerLab.com (Economically Motivated Adulteration in the Dietary Supplement Market Place, William Obermeyer Ph.D., VP Research)
11. The Pew Charitable Trusts (Protecting Consumers from Adulterated Drugs, Allan Coukell, Director, Pew Prescription Project)
12. Center for Science in the Public Interest (Comments on Economically Motivated Adulteration, Xuman Amanda Tian, Research Associate, Food Safety Program)
13. Grocery Manufacturers Association (GMA) (Economically Motivated Adulteration, Craig W. Henry Ph.D., Senior Vice President, and Chief Operating Officer, Scientific and Regulatory Affairs)

Everything might have been different if that first working definition of EMA referred broadly to “adulteration” as specified in the FDCA. Nevertheless, terms that are now used in FSMA guidance such as the qualified individual training are “economically motivated food safety hazard” and “economically motivated hazard.”

Sidebar: A Treatise on Adulteration of Food in 1820 by Frederick Accum

An appropriate end to this Introduction chapter on definitions is to review the very earliest research on food fraud. The food fraud concept has been confusing from the start. Accum's book published in 1820 was apparently the first citation for the use of the term "food adulteration." Frederick Accum published *A Treatise on Adulteration of Food* (Accum 1820). The full title is "A Treatise on Adulteration of Food and Culinary Poisons exhibiting the Fraudulent Sophistications of [various products] and the Methods of Detecting Them." There are no definitions of adulteration, adulterated, adulterant, counterfeit, or contaminant, and he does not use the term "substance."

Accum's statement is (emphasis added):

- "This treatise, as its title expresses, is intended to exhibit easy methods of detecting the fraudulent adulterations of food, and of other articles, classed either among the necessaries or luxuries of the table; and to put the unwary on their guard against the use of such commodities as are contaminated with substances deleterious to health."

But, what exactly does he think is adulteration?

Accum did mention "the fraudulent adulterations of food," "the detection of frauds," and "counterfeit" products then shifted the focus of the research to test methods for "detection of the adulteration of foods." He refers to "the adulteration of food" (interpreted as the intentional deception of usually a lower quality version of the product) and "counterfeit" (interpreted as the intentional deception of substituting a different product) though here he does not use the phrase "food adulteration" or "adulterant."

Thus, Accum appears to consider that of the many types of adulteration of food, one type is fraudulent adulteration using a lower quality substance, and another is counterfeiting by substituting another product. The lack of a clear definition has created confusion from the very start of attempting to prevent food fraud.

Conclusion

This Introductory Chapter—and the starting point for the book—began at the most logical starting point which is reviewing the definition and scope of food fraud. Considering the definition of this and related terms—including a consideration of the prevention-focused objective—helps set the direction of the research. The direction from the 2018 CODEX CCFICS Chairman directed the Electronic Working Group on Food Integrity and Food Authenticity food fraud and was consistent with this idea that definition clarity would self-direct the next steps. *The first conclusion is* that the most logical starting point to review the Food Fraud Prevention Strategy

is, to begin with, the definition of the term. As a series of incidents have become more and more impactful, the problem has been more clarified from covering adulterant-substances to mislabeling and then counterfeiting and a realization that a holistic, all-encompassing approach is to address all types of fraud. *The second conclusion is* that food fraud prevention follows the saying that "common sense is neither common nor sense." It might seem that "everyone knows what that means" is not always so and when applied to food fraud is often *not* the case. A simple first step is to clarify the definition and scope of the research question and then confirm the end use of the information. *General i*nformation *generally* helps, and *specific* information *specifically* helps. Without a clear definition and scope, combined with a clear specification of what decision is being addressed, the projects often end in confusion or a report that is not useable. *The final conclusion is* that to understand the current state and focus, it is important to review the applicability of the core source documents such as Accum's treatise on food adulterations or the FDA working definition of economically motivated adulteration. Over time, as the scope of food fraud is clarified and the prevention priority, some of the original concepts may adapt to be more appropriate.

There is a saying:

> ***We're not trying to catch bad product but to prevent food fraud from occurring in the first place***.

The next chapter on an introduction to the concepts will expand on the introduction to the concept before a deeper dive into the specific topics (Fig. 1.7).

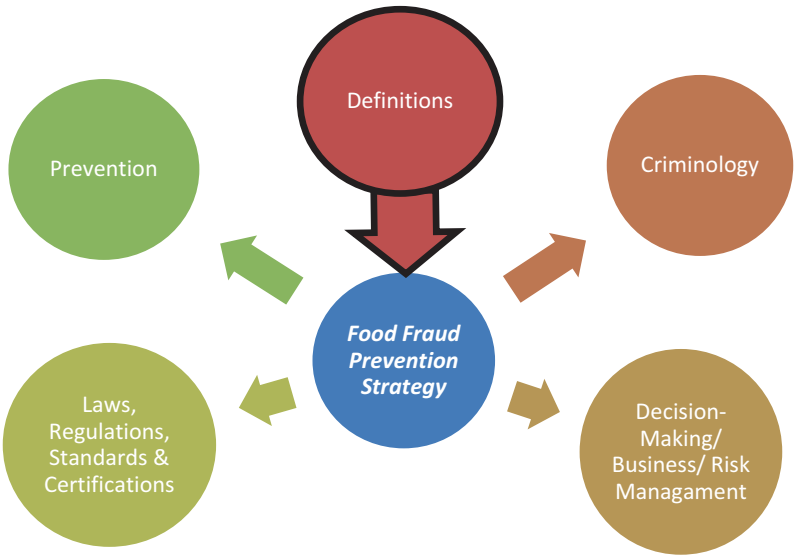

Fig. 1.7 Example of confirming definitions and scope before beginning to create the Food Fraud Prevention Strategy that is comprised of specific disciplines

Appendix: WIIFM Chapter on Introduction and Definitions

This "What's In It For Me" (WIFFM) section explains why this chapter is important to you.

Business functional group	Application of this chapter
WIIFM all	Food fraud is a new topic, and this chapter provides a very thorough review and foundation of the definition and scope—just follow the recommendation
Quality team	Use this to identify where to expand your focus from traditional food safety to food fraud prevention—from biological sciences to criminology and business risk assessment
Auditors	This supports your awareness of "what is food fraud?"
Management	This is scholarly support for the broader foundation that is usually addressed by a food quality team
Corp. Decision-makers	The employees have a process that is based on a theoretically sound and widely researched foundation

Appendix: Study Questions

This section includes study questions based on the key Learning Objectives in this chapter.

1. Discussion Question
   (a) Why must FF be addressed by a company or country?
   (b) What are the major challenges to creating and then implementing an FFPS?
   (c) How does a government FFPS differ from a company strategy?
2. Key Learning Objective 1
   (a) What is the definition of a "problem"?
   (b) Why is "Establishing the context" critical?
   (c) How is "success" measured?
3. Key Learning Objective 2
   (a) What is the definition of "food fraud"?
   (b) Explain EMA in relation to food fraud?
   (c) What is the relationship between food authenticity and food integrity?
4. Key Learning Objective 3
   (a) What is the "Food Risk Matrix"?
   (b) How is food fraud different from food defense?
   (c) Where is a "disgruntled employee" applied in the Food Risk Matrix?

References

Accum, F. C. A. (1820). *A treatise on adulterations of food, and culinary poisons*. London: Longman, Hurst, Rees, Orme, and Brown.

Barnard, C., & O'Connor, N. (2017). Runners and riders: The horsemeat scandal, EU law and multi-level enforcement. *Cambridge Law Journal, 76*(1), 116. https://doi.org/10.1017/S000819731700006X.

Black's, Black's Law Dictionary. (2014). In B. A. Garner (Ed.), *Black's Law dictionary* (10th ed.). St. Paul: Thomson Reuters, ISBN-10: 0314613005.

Clarke, R. V., & Eck, J. E. (2005). *Crime analysis for problem solvers in 60 small steps*. Washington, DC: Center for Problem Oriented Policing.

CODEX, Codex Alimentarius. (1995). CODEX general standard for contaminants and toxins in food and feed, CODEX STAN 193-1995. 2012, from www.codexalimentarius.net/input/download/standards/17/CXS_193e.pdf

CODEX, Codex Alimentarius. (2014). Procedural manual, 12. World Health Organization/Food and Agriculture Organization of the United Nations, Geneva/Rome.

CODEX, Codex Alimentarius. (2017). Invitation to participate in the CCFICS EWG on food integrity and food authenticity, home page for WG on food integrity and food authenticity - CCFICS 23, August 7, 2017, URL: http://www.fao.org/fileadmin/user_upload/codexalimentarius/invitations/EWG%20Kick%20off%20message%20fraud.pdf

COSO, Committee of Sponsoring Organizations of the Treadway Commission. (2016). *Fraud Risk Management Guide*. Washington, DC: COSO Publication, URL: https://www.coso.org/Documents/COSO-Fraud-Risk-Management-Guide-Executive-Summary.pdf.

DEFRA, United Kingdom Department for Environment, Food & Rural Affairs. (2014). Elliott review into the integrity and assurance of food supply networks, Independent report, Ref: PB14089, PDF, 539KB, 84 pages, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/350726/elliot-review-final-report-july2014.pdf

DOJ, Department of Justice. (2019). US Department of Justice's Criminal Resource Manual, CRM 1500-1999, Criminal Resource Manual 1801-1899DURL: https://www.justice.gov/jm/criminal-resource-manual-1854-copyright-infringement-first-sale-doctrine

DOJ, Department of Justice. (2013). *DOJ, Prosecuting Intellectual Property Crimes Manual 2013* (4th ed.). Office of Legal Education Executive Office for United States Attorneys, URL: https://www.justice.gov/sites/default/files/criminal-ccips/legacy/2015/03/26/prosecuting_ip_crimes_manual_2013.pdf.

EC, European Commission. (2014). On the food crisis, fraud in the food chain and the control thereof.

EU FIP, European Union Food Integrity Project. (2017). Home Page, URL: https://secure.fera.defra.gov.uk/foodintegrity/index.cfm

FAO, Food and Agriculture Organization of the United Nations. (2013). FAO, 2013, Praedial Larceny in the Caribbean, Issue Brief, Subregional Office for the Caribbean, July 2013, URL: http://www.fao.org/docrep/019/as086e/as086e.pdf

FDA, U.S. Food and Drug Administration. (2007). Food protection plan.

FDA, U.S. Food and Drug Administration. (2011). Food Safety Modernization Act (FSMA). 111th Congress Public Law 353. USA.

FDA, U.S. Food and Drug Administration. (2015). Federal Food, Drug, and Cosmetic Act (FD&C Act), Home Page, www.FDA.gov. Accessed 15Oct 2016.

FDA, U.S. Food and Drug Administration. (2016). FSMA Public Call: Final rule on Mitigation strategies to protect food against intentional adulteration, FDA Food Defense Coordination staff, presented by Dr. Steve Ostroff and Dr. Ryan Newkirk, Thursday, May 26, 2016, 12:00 to 1pm ET, URL: http://www.fda.gov/Food/GuidanceRegulation/FSMA/ucm378628.htm

FDA, U.S. Food and Drug Administration. (2009). Economically motivated adulteration; public meeting; request for comment, [Docket No. FDA-2009-N-0166]. *Federal Register, 74*, 15497.

GAO, United States General Accounting Office. (1995). GAO Report to Congressional Committees, Fruit juice adulteration: Detection is difficult, and enhanced efforts would be costly. (November 1995): GAO/RCED-96-18.

GFSI, Global Food Safety Initiative. (2014). GFSI position on mitigating the public health risk of food fraud, global food safety initiative, consumer goods forum.

GFSI, Global Food Safety Initiative. (2017). Guidance document, benchmarking document, Version 7, URL: http://www.theconsumergoodsforum.com/files/Publications/GFSI_Guidance_Document_Intro.pdf

GFSI, Global Food Safety Initiative. (2018). Food fraud technical document, tackling food fraud through Food Safety Management Systems, May 9, 2018, URL: http://www.mygfsi.com/files/Technical_Documents/201805-food-fraud-technical-document-final.pdf

Hopkins, D. M., Kontnik, L. T., & Turnage, M. T. (2003). *Counterfeiting exposed: How to protect your brand and market share*. Hoboken: Wiley.

Huisman, W., & Spapens, T. (2016). Tackling cross-border environmental crime: A 'Wicked Problem'. environmental crime in transnational context, Routledge: pp. 43–58.

ISO, International Organization for Standardization. (2009). ISO 31000:2009 Risk Management - Principles and Guidelines.

ISO, International Organization for Standardization. (2018). ISO 22380:2018 Security and resilience -- Authenticity, integrity and trust for products and documents -- General principles for product fraud risk and countermeasures, Status: Published, Publication date: 2018-08-22 URL: https://www.iso.org/standard/73857.html

Lam, J. K., & Spink, J. (2018). Developing a preliminary model to identify food fraud within the meat industry, Food Fraud Initiative Report, May 25, 2018, Michigan State University, www.FoodFraud.msu.edu

Manning, L., & Soon, J. M. (2016). Food safety, food fraud, and food defense: A fast evolving literature. *Journal of Food Science, 81*(4), R823–R834.

Merriam-Webster. (2004). The Merriam-Webster Dictionary -- New Edition.

MSU-FFI, Food Fraud Initiative. (2018). Blog series, Food Fraud Initiative, Michigan State University, developed and presented by John Spink, URL: www.FoodFraud.msu.edu/Blog/

NFCU, UK National Food Crime Unit. (2017). What is food crime and how does it differ from food fraud? Web-page, URL: https://www.food.gov.uk/enforcement/the-national-food-crime-unit/what-is-food-crime-and-food-fraud

Petrova Dickinson, V. K., & Spink, J. (2019). Food Fraud requirements: Comparison of GFSI and Certified Program Organizations – Annual update, December 2018, MSU Food Fraud Initiative MSU-FFI), Food Fraud Initiative Report (FFIR).

Primrose, S., Woolfe, M., & Rollinson, S. (2010). Food forensics: Methods for determining the authenticity of foodstuffs. *Trends in Food Science & Technology, 21*(12), 582–590.

PWC, PriceWaterhouseCooper. (2016). Food fraud vulnerability assessment, Online Tool, Produced with SSAFE Organization, http://www.pwc.com/gx/en/food-supply-integrity-services/publications/food-fraud-vulnerability-assessment.pdf

Spink, J. (2007). *Global Counterfeit Food and Beverage Packaging: Impacts on Food Safety*. Association of Food and Drug Officials (AFDO), Annual Conference. San Antonio, Texas, AFDO.

Spink, J. (2009a). *Analysis of counterfeit risks and development of a counterfeit product risk model*. PhD Dissertation Ph.D., Michigan State University.

Spink, J. (2009b). Defining food fraud & the chemistry of the crime. American Association for the Advancement of Science (AAAS) 2009 Annual Meeting, February 16, 2009, URL: http://news.msu.edu/media/documents/2009/02/8591a06e-5981-4660-8866-0bb281d6f9f4.pdf, URL Video: https://www.eurekalert.org/multimedia/pub/12267.php. Chicago.

Spink, J. (2014a). Annual survey study of product counterfeiting by Michigan Residents utilizing the MSU State of the state survey: Implications for food fraud (SOSS, MAPPR). Food Fraud Initiative, Michigan State University.

Spink, J. (2014b). Food fraud prevention overview, Introducing the Food Fraud Prevention Cycle (FFPC)/ Food Fraud Prevention System, GFSI China Focus Day 2014, Beijing.

Spink, J. (2019). Chapter: Food fraud prevention – selecting the right test, method, and sampling plan. In M. Burns, L. Foster, & M. Walker (Eds.), *DNA techniques to verify food authenticity: Applications in food fraud, food chemistry, function and analysis*. Royal Society of Chemistry, ISBN 1788011783, 9781788011785.

Spink, J., & Moyer, D. C. (2011a). *Backgrounder: Defining the public health threat of food fraud. Research Grants*. Minneapolis: National Center for Food Protection and Defense, http://www.ncfpd.umn.edu/: 7.

Spink, J., & Moyer, D. C. (2011b). Defining the public health threat of food fraud. *Journal of Food Science, 76*(9), R157–R162.

Spink, J., Moyer, D. C., Park, H., & Heinonen, J. A. (2013). Defining the types of counterfeiting, counterfeiters, and offender organizations. *Crime Science, 2*(8), 1–9.

Spink, J., Fortin, N. D., Moyer, D. C., Miao, H., & Wu, Y. (2016a). Food fraud prevention: Policy, strategy, and decision-making–implementation steps for a government agency or industry. *Chimia International Journal for Chemistry, 70*(5), 320–328.

Spink, J., Moyer, D. C., & Whelan, P. (2016b). The role of the public-private partnership in food fraud prevention—includes implementing the strategy. *Current Opinion in Food Science (COFS), 10*, 68–75.

Spink, J., Zhang, G., Chen, W., & Speier-Pero, C. (2019). Introducing the food fraud prevention cycle (FFPC): A dynamic information management and strategic roadmap. *Food Control, 105*, 233–241.

SSAFE, SSAFE Organization. (2015). Food Fraud Vulnerability Assessment Tool - FFVAT, (formerly : Safe Secure and Affordable Food For Everyone organization), December 16 2015, URL: http://www.ssafe-food.org/

US DOJ, U.S. Department of Justice. (2017). Terms & definitions: Crime type, Office of Justice Programs, Bureau of Justice Statistics, Page last revised on 12/06/2017, URL: https://www.bjs.gov/index.cfm?ty=tdtp&tid=3

van Ruth, S. M., Huisman, W., & Luning, P. A. (2017). Food fraud vulnerability and its key factors. *Trends in Food Science & Technology, 67*, 70–75.

van Ruth, S. M., Luning, P. A., Silvis, I. C. J., Yang, Y., & Huisman, W. (2018). Differences in fraud vulnerability in various food supply chains and their tiers. *Food Control, 84*, 375–381.

WHO, World Health Organization. (2009). Food security. Retrieved January 29, 2009, from http://www.who.int/trade/glossary/story028/en/

WTO, World Trade Organization. (1994). Agreement on trade related aspects of intellectual property rights, including trade in counterfeit goods. Retrieved May 4, 2007, from http://www.wto.org/english/docs_e/legal_e/27-trips_05_e.htm

Wu, Y., Hong, M., Shao, B., Zhang, J., Spink, J., & Moyer, D. C. (2017). Chapter 15: Food fraud [English language]. In J. J. Jen & J. Chen (Eds.), *Food safety in China - past, present, and future:, science, technology, management and regulation* (p. 1). Wiley-Blackwell Publishing.