Chapter 9
Supply Chain Management (Part 1 of 2): Fundamentals

Summary

This chapter presents the discipline of Supply Chain Management—both the functions of product moving in the proprietary supply chain from manufacturing to the consumer and also the science of logistics, operations, and procurment supply chain management. This chapter will introduce the foundational concepts as well as general applications, review key issues such as globalization and an ever more digital supply chain (positives and negatives), and then the role in food fraud prevention.

The Key Learning Objectives of this chapter are

- (1) **Supply Chain Management Introduction:** Understand the science of supply chain management.
- (2) **Supply Chain Characteristics:** Review the application of supply chain management to food fraud prevention.
- (3) **Business Continuity Planning and Crisis Management:** Review of the management function with specific food fraud prevention examples.

On the Food Fraud Prevention Cycle (FFPC), this chapter addresses the theoretical foundation concepts related to supply chain management in "(A) Academic Disciplines" (Fig. 9.1).

Introduction

Supply chain management (SCM) is a crucial discipline in food fraud prevention because, naturally, the material goods must be delivered and managed through a supply chain to a customer and consumer (Voss et al. 2009; Speier et al. 2011). As commerce has become both more complex and complicated, supply chain management provides methods to manage the complexity as well as the associated risk and uncertainty. Product fraud and food fraud are problems that are escalating due to the emerging fraud opportunity created by more products moving farther and faster

J. W. Spink, *Food Fraud Prevention*, Food Microbiology and Food Safety,
https://doi.org/10.1007/978-1-4939-9621-6_9

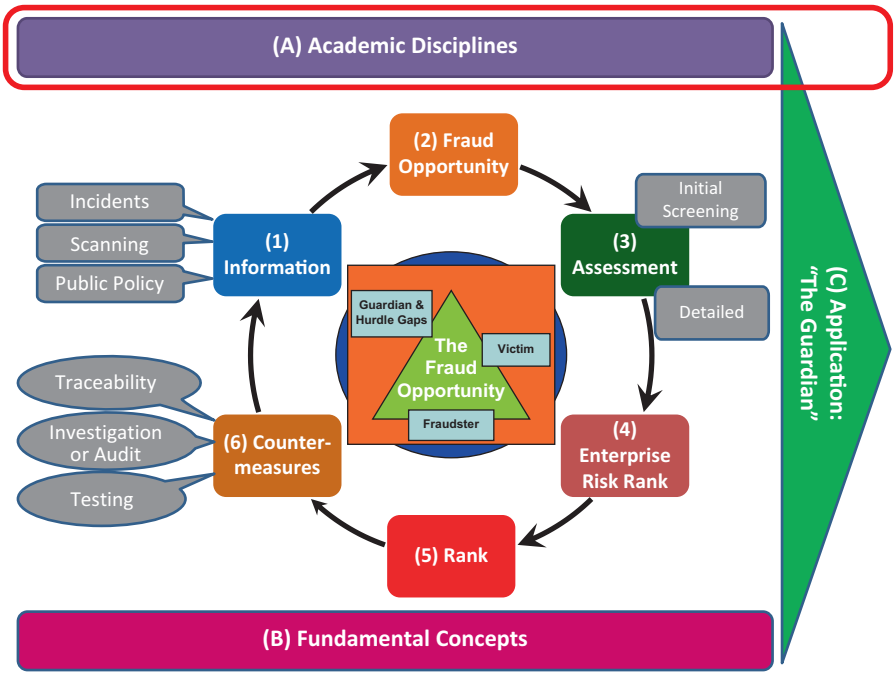

Fig. 9.1 Food Fraud Prevention Cycle—Where this chapter applies to the overall concept "(A) Academic Disciplines". (Copyright Permission Granted) (Spink 2014; Spink et al. 2019)

around the world. The foundation of supply chain management is vital to understand both to find ways to leverage the systems but also to assist in a more productive supply chain.

In general, the discipline of supply chain management is essential for food fraud prevention because:

- Supply chains are vulnerable to food fraud, and the threat is currently misunderstood and often underestimated.
- Current internal controls and visibility of the product help reduce the fraud opportunity.
- Supply chain management is a separate business discipline, and a basic understanding is important to seek efficiencies.

This chapter will present the supply chain management concepts and then expand to consider the application to food fraud prevention.

Key Learning Objective 1: Supply Chain Management Introduction

This section will cover an overview of supply chain management (SCM) including that this is a specific area of academic research and study.

The Key Learning Objectives of this section are

- (1) Introduction to the academic discipline of supply chain management
- (2) Review of the complexity of supply chain management
- (3) The role of procurement in business management and vulnerability reduction

Theoretical Foundation

Supply chain management (SCM) is the science of "multiple firms collaborating to leverage strategic positioning and to improve operating efficiency" (Bowersox et al. 2002). It is also defined as "a network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the end user or consumers" (Christopher 2016). Generally, this is a collaboration and coordination of product flowing through from the manufacturing, distribution, storage, and presentation of the product to the customer (Bowersox et al. 2002). In the 1950s there was a specific focus on ***logistics*** which is the management and control within a company's proprietary supply chain and essentially the "work required to move and geographically position inventory" (Bowersox et al. 2002). With growing computing power and globalization, there was a need to expand the focus from logistics to the overall supply chain. The modern science of Supply Chain Management has expanded to include Procurement (purchasing), Operations Management (quality control, inventory, and scheduling), and Logistics (transportation).

Since the 1970s, supply chain management has been an autonomous academic discipline. In the USA there are over 100 universities that offer a bachelor's degree and over 30 that offer a Ph.D. in Supply chain management. This is often a separate department within a business school.

A foundational concept is the generalized supply chain model which is presented here (Fig. 9.2). Each step includes a complex web or network of participants and

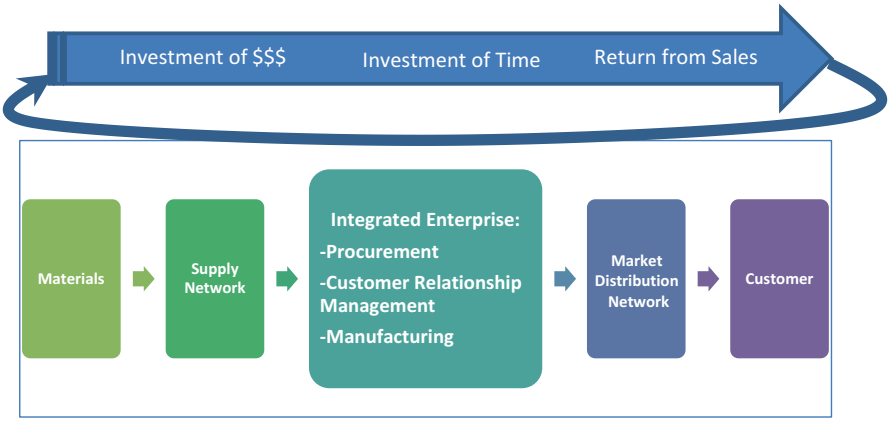

Fig. 9.2 Adaptation of the generalized supply chain model. (Adapted from (Bowersox et al. 2002))

processes. "The integrated supply chain perspective shifts traditional channel arrangements from loosely linked groups of independent businesses that buy and sell inventory to each other toward a managerially coordinated initiative to increase market impact, overall efficiency, continuous improvement, and competitiveness" (Bowersox et al. 2002).

For food fraud prevention, at each step in the supply chain fraud can occur and disrupt the system. As the supply chain becomes more complex and more automated, the fraud opportunity shifts and evolves. A lack of consideration of the fraud opportunity has been catastrophic for the supply chain of a product, company, or industry. Fortunately, the collaboration and coordination that is effective in supply chain management can evolve to consider and combat product fraud.

Supply Chain Complexity

The supply chains are getting more complicated and complex. They are complicated since more products are moving farther and faster around the world. They are more complicated because of the multiple hand-offs with more requirements for the transaction information. Three main factors reported have accelerated the development of supply chain management that includes (Black's 2014):

"(1) Information and communication technology (ITC)
(2) Global competition and expansion
(3) Integration and interrelationships."

The globalization is a great opportunity for the industry to expand markets and also for governments to expand their economies.

While globalization and electronic communication have increased the speed and efficiency of commerce, it also has some unintended side effects. With more products moving around the world farther and faster, the minimum economic scale of manufacturing has grown (Porter 1980). A manufacturing plant often produces a product that is used—literally—around the world. There are considerable economic and quality control efficiencies with bigger, fewer providers but also narrowing of supply through key nodes. With fewer and bigger suppliers, one quality control or production disruption can literally have global ramifications.

The expanding global supply chains also sometimes create uncertainty since there is often less transparency of the transactions, sometimes less control at each step, and generally more variables in the entire process. The uncertainty is in addition to usual risks—uncertainty is the inability to know in advance the exact likelihood of future events. Risk and uncertainty are two key variables that are a focus of the Enterprise Risk Management system implemented by COSO (2013):

- ***Risk (ERM/COSO):*** "The possibility that an event will occur and adversely affect the achievement of objectives" (COSO 2011).
- ***Uncertainty (ERM/COSO):*** "The inabilities to know in advance the exact likelihood of future events" (COSO 2011).

One complexity is that there is possibly a global network of direct suppliers (Tier 1) who also could be buying from a global network of suppliers (Tier 2) who then, in turn, could be buying from a global network of suppliers (Tier 3). There are usually strong relationships and oversight of the Tier 1 suppliers but less and less deep into the supply chain. A traditional tiered supplier structure is that one supplier buys from many, and there is the safety of many suppliers able to support the needs. The lack of supply chain transparency could inadvertently create a dangerous supply situation where many Tier 1 suppliers actually buy from few Tier 2 suppliers who, in turn, may actually be from only a handful or a single Tier 3 supplier. The danger is a lack of awareness that a company's supply chain—or even an industry-wide supply chain—could be impacted by supply variability at one, single supplier.

Tiered Supplier Structure—Traditional: Many-to-One While there can be visibility and management of Tier 1 suppliers (first supplier selling directly to a manufacturer), there is less transparency for Tier 2 (they sell to the first supplier who in turns sells to the manufacturer) and even less for Tier 3 (they sell to the Tier 2 suppliers) (Fig. 9.3). This is a concern for quality management but also for supply continuity. Usually, but not always, Tier 1 supplier buys from many Tier 2 suppliers who, in turn, buy from many Tier 3 suppliers. In practice, this is a dangerous assumption. In some cases, a key component could be produced by one company for wide-scale use across the entire supply chain.

Tiered Supplier Structure—Dangerous: One-to-Many: If there are only a few—or one—Tier 3 suppliers for the Tier 1 and Tier 2 suppliers, then a problem at the Tier 3 suppliers can cripple a supply chain and entire industries (Fig. 9.4).

The lack of risk awareness in *non*transparent, multitiered supply chain could add an additional variable of a lack of communication of standards or food safety requirements. The Tier 2 or Tier 3 suppliers may not understand the end customer

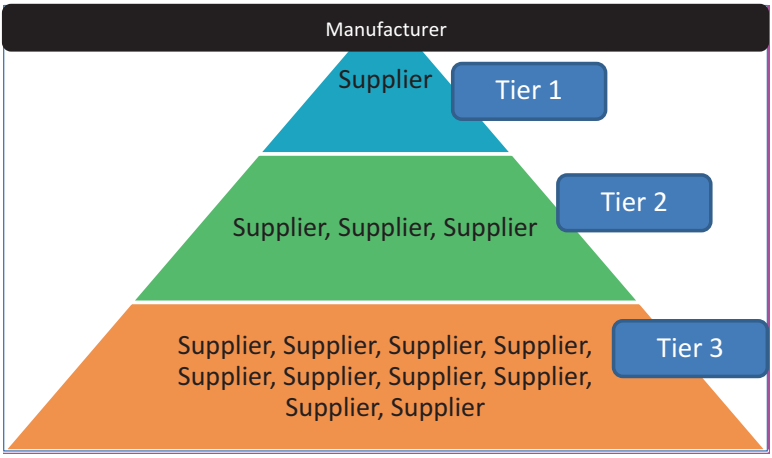

Fig. 9.3 Traditional tiered supply chain structure—traditional: many-to-one

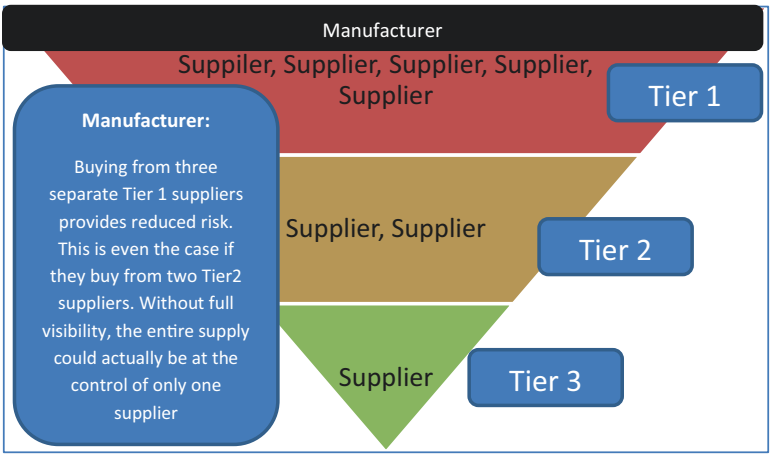

Fig. 9.4 Supply chain example of a dangerously tiered distribution network including Tier 1, Tier 2, and Tier 3

specifications or needs. The Tier 2 and Tier 3 suppliers may not even know who the manufacturer is. It is possible that the Tier 2 supplier does not correctly specify the product from the Tier 3 supplier, and the fraud opportunity is that the Tier 3 supplier can intentionally—but possibly not illegally—provide a different product than specified.

This is not only a plausible example; this is an actual incident where several automobile manufacturing plants were shut down due to the Japanese Fukushima Daiichi Tsunami incident. Several Tier 1 and Tier 2 suppliers all relied on the material from the Tier 3 supplier who was shut down during the tsunami (MacKenzie et al. 2012; Reuters 2016). For a specific example from this incident, the closure of one manufacturing plant that produced the material used to manufacture an 18″ fuel tube for many auto manufacturers' led to worldwide automobile production shutdowns (Massey 2011). This is not a one-time anomaly since another time a fire at a local Michigan automobile parts supplier shut down several automobile manufacturing plants due to a lack of supply (Howard 2018).

Important Concepts and Focus Areas

To control for the uncertainty and risks inherent in business or government activities, there are many systems or programs that have been developed and refined such as quality management.

Total quality management (TQM) is a coordinated effort to identify and address the root causes of anomalies that negatively impact the final product or the operations (Boyer 1996; Jayjock et al. 1997). The overall focus shifted from Juran in 1951 focusing on controls in the *Quality Control Handbook* then Feigenbaum in

1956 shifted along the control spectrum to "total quality control" (TQC). In 1987 Gavin, among others such as Deming, Crosby, and Kaizen, further broadened the focus to "strategic quality management" or eventually the hybrid of TQM. The evolution was from controls and catching bad product to designing flaws or anomalies out of systems. For the food industry, quality assurance or quality management are familiar function titles.

There are eight dimensions of quality. These also possibly apply to the broader food concept of food integrity (Garvin 1987):

- Performance: how the product performs compared to expectations or specification
- Reliability: likelihood that the product will perform as intended
- Durability: likelihood that the product will perform over an expected period of time
- Conformance: meeting a specific description or attribute as designed
- Features: number of functions it is intended to perform
- Aesthetics: style, material, etc.
- Serviceability: ease of repairing or fixing compared to expectation
- Perceived quality: value judgment

One TQM program is Six Sigma—or a zero defects focus—program and processes that are widely adopted. For food fraud prevention, it is efficient to use TQM and Six Sigma concepts not only for the familiarity but due to the utility of the programs. The basic management of Six Sigma is five phases for of product or process development of define, measure, analyze, design, and verify (DMADV) or ongoing monitoring including stages of define, measure, analyze, improve, and control (DMAIC). These are basic concepts of plan-do-check-act (PDCA) that are the base for more general analysis management such as in ISO 31000 and applied assessments such as in the criminology scanning, analysis, response, and assessment method (SARA).

To prioritize the risk treatments, the basic quality management methods require an assessment of the overall problem (how can you say you're addressing the most critical problem if you haven't assessed the entire system) and also some factors that can be measured (define success metrics that can actually be measured and that realistically reduced the fraud opportunity).

The fraud opportunity can be deconstructed into measurable component root causes that are critical control points. While addressing food safety in a HACCP (hazard analysis) program is very different from addressing food defense in a VACCP program (vulnerability assessment)—or food defense in a TACCP program (threat assessment)—the underlying method applies (GFSI 2018). The underlying quality management principles are to identify the root cause, change operations to reduce the chance for the anomaly to occur, and then continually review the system remains in compliance.

"In the recent years, the Six Sigma program for quality and process improvement has been adopted by many of the larger firms in the United States and around the world" (Bowersox et al. 2002). The core of Six Sigma is based on the concept of a

statistical standard of deviation where the standard of deviation (one sigma) would result in 68% of the production meeting specification. To be a successful business, the Six Sigma system expands the goal to six standards of deviation (six sigma) or 99.99966% of the production meeting specification (3.4 defects per 1 million units produced) (NIST; ISO 2011a, b). As a raw percentage that may seem like an unrealistically low number but the errors can compound, the costs of just one nonconformance can be a global product recall costing hundreds of millions of dollars. A "defect" is something that is outside the customer specification—the customer specification should be clearly defined and expressed in a measurable factor.

There are four TQM types of costs (Jayjock et al. 1997):

- ***Appraisal (audit)***: the cost of inspections to assess quality levels
- ***Internal failure***: costs of failures before the product is shipped
- ***External failure***: costs of failure after shipped including recall, settlements, lost sales, rework, etc.
- ***Preventive (countermeasures or control systems)***: efforts to control quality or to mitigate failure costs

For food fraud prevention, without conducting a vulnerability assessment, the impact on the firm is not—and, thus, cannot be—evaluated. In most cases, the vulnerability is very low and does *not* lead to a risk that is so dangerous or costly that it must be mitigated. Often, when evaluating the vulnerability in relation to quality, there are many very simple, low-cost, efficient, and effective countermeasures and control systems.

Sidebar: HACCP as a Total Quality Management System

While the primary systems are based on quality management, food scientists often scoff at the idea that HACCP is a quality management system rather than a public health assessment. HACCP is focused on public health threats and the use of rigorous and methodical control systems to focus on and reduce the hazards. To review, the US FDA defines HACCP as:

- "***HACCP*** is a management system in which food safety is addressed through the analysis and control of biological, chemical, and physical hazards from raw material production, procurement, and handling, to manufacturing, distribution, and consumption of the finished product"(FDA 2017).

HACCP is the application of a total quality management system to foods, and they both are aligned with international standards. One of the most widely adopted quality management systems is ISO 9000 Quality Management which was updated in 2015 and reportedly has over 1.1 million certificates issued worldwide (e.g., companies or locations that are certified to have met the requirements of the standard) (ISO 2015).

The International Standards Organization (ISO) with the most widely adopted and original quality system of ***ISO 9000*** series is "A quality

management system is a set of policies, processes, and procedures required for planning and execution (production/development/service) in the core business area of an organization" (ISO 2015). The ISO 9000 section "8.3 Control of Non-conforming Products" does state "customers seeking confidence in an organization's ability to consistently provide products and services conforming to their requirements." So considering the definitions of HACCP and quality management, HACCP is a quality management system that focuses on the management and control of a specific set of nonconformances that, if not controlled, could lead to public health hazards. The refinements in HACCP plan are a way to apply a specific method for the hazard identification and hazard analysis (the "HA" in "HACCP") then identifying the root causes of the nonconformances by identifying and managing critical control points (the "CCP" in "HACCP"). For HACCP, a CCP might be controlling and monitoring the temperature of a refrigerator. The HACCP principles are built upon basic quality management principles. It is logical to also base food fraud prevention concepts on a quality management system, to apply a specific method for the vulnerability assessment (the "VA" in VACCP), and then to identify the root causes of nonconformances by identifying and managing critical control points (the "CCP" in VACCP). A food fraud "CCP" might be to occasionally conduct and document a species test to confirm a supplier certificate of analysis.

Sidebar: ISO 9000 Key Terms

While reviewing quality management, it is good to review the key concepts and their definition. From ISO 9000 (with ISO 9000 section references) (ISO 2015):

Quality policy: policy (3.5.8) related to quality (3.6.2); Note 1 to entry: Generally the quality policy is consistent with the overall policy of the organization (3.2.1), can be aligned with the organization's vision (3.5.10) and mission (3.5.11), and provides a framework for the setting of quality objectives (3.7.2).

Quality objective: objective (3.7.1) related to quality (3.6.2); Note 1 to entry: Quality objectives are generally based on the organization's (3.2.1) quality policy (3.5.9); Note 2 to entry: Quality objectives are generally specified for relevant functions, levels, and processes (3.4.1) in the organization (3.2.1).

Quality planning: part of quality management (3.3.4) focused on setting quality objectives (3.7.2) and specifying necessary operational processes (3.4.1) and related resources to achieve the quality objectives; Note 1 to entry: Establishing quality plans (3.8.9) can be part of quality planning.

(continued)

Quality assurance: part of quality management (3.3.4) focused on providing confidence that quality requirements (3.6.5) will be fulfilled.
Quality control: part of quality management (3.3.4) focused on fulfilling quality requirements (3.6.5).
Quality improvement: part of quality management (3.3.4) focused on increasing the ability to fulfill quality requirements (3.6.5); Note 1 to entry: The quality requirements can be related to any aspect such as effectiveness (3.7.11), efficiency (3.7.10), or traceability (3.6.13).

Combining these quality management principles, there is an overall goal of product quality through management (Fig. 9.5).

There are several more terms in those definitions include:

Quality: degree to which a set of inherent characteristics (3.10.1) of an object (3.6.1) fulfills requirements (3.6.4); Note 1 to entry: The term "quality" can be used with adjectives such as poor, good, or excellent; Note 2 to entry: "Inherent," as opposed to "assigned," means existing in the object (3.6.1).
Management: coordinated activities to direct and control an organization (3.2.1); Note 1 to entry: Management can include establishing policies (3.5.8) and objectives (3.7.1) and processes (3.4.1) to achieve these objectives; Note 2 to entry: The word "management" sometimes refers to people, i.e., a person or group of people with authority and responsibility for the conduct and control of an organization. When "management" is used in this sense, it should always be used with some form of qualifier to avoid confusion with the concept of "management" as a set of activities defined above. For example, "management shall…" is deprecated, whereas "top

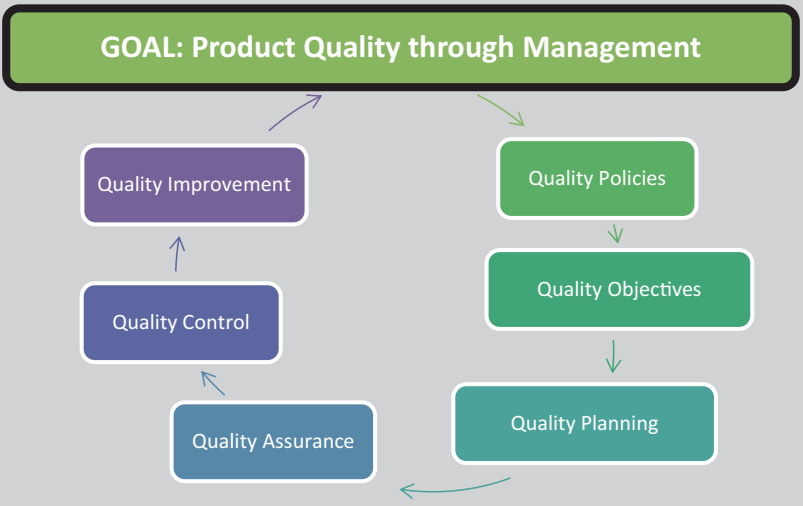

Fig. 9.5 ISO 9000 GOAL: Product quality through management

management (3.1.1) shall…" is acceptable. Otherwise different words should be adopted to convey the concept when related to people, e.g., managerial or managers.

Policy: (organization) intentions and direction of an organization (3.2.1) as formally expressed by its top management (3.1.1); Note 1 to entry: This constitutes one of the common terms and core definitions for ISO management system standards given in Annex SL of the Consolidated ISO Supplement to the ISO/IEC Directives, Part 1.

Strategy: plan to achieve a long-term or overall objective (3.7.1).

Objective: result to be achieved; Note 1 to entry: An objective can be strategic, tactical, or operational.

The concepts of "strategy" and "strategic" were not fully defined in ISO 9000, so other ISO standards were considered, specifically ISO/IEC TR 33014:2013 which addresses process improvement on three levels (ISO 2013).

Strategic: what goals to achieve, the motivation, and direction
Tactical: how to achieve the goals of process improvement
Operational: how to perform the process improvement

The Role and Responsibility of the Procurement Function

The procurement objectives are to purchase the specified product at the lowest cost and with high reliability of the quality of the product in conjunction with a continuous supply. It is too simplistic to vilify purchasing managers as only focusing on "lowest cost product." While "No one wants to pay a higher price than necessary," the focus is the "lowest total cost of ownership" (Bowersox et al. 2002). The firm must define the specifications for the procurement. The specifications include the "risk appetite" of the enterprise which manages all risks or vulnerabilities. That said, "What gets measured gets better" would have an opposite idea of "what doesn't get measured doesn't get better" or maybe "what doesn't get measured can kill a company."

Procurement objectives are (Bowersox et al. 2002):

- Continuous supply
- Minimize inventory investment (on-hand inventory)
- Quality improvement
- Supplier development
- Access technology and innovation
- Lowest total cost of ownership (low cost per unit plus all related costs)

For food fraud prevention, the vulnerabilities should be plotted on the corporate risk map to be able to consider and evaluate the fraud opportunity of the suppliers and supply chains. If a Food Fraud Prevention Strategy is implemented, then there can be a robust evaluation of the fraud opportunity and the benefits of purchasing

from a higher-quality supplier, conducting additional authenticity tests in-house, entirely avoiding a type of product such as by changing a recipe, discontinue producing a vulnerable product group, or to define what the current or commodity purchases are within the risk appetite.

Sidebar: Purchasing Higher-Priced Truck Engines for Lower Fuel Consumption Costs

At the start of the Wal-mart corporate environmental sustainability initiatives around 2007, their corporate leadership considered the changing market conditions and the uncertain financial impact on the business. The Wal-mart corporate environmental sustainability initiatives were conceived in then CEO Lee Scott's "21st Century Leadership Speech" (Scott 2005). Diesel fuel prices were projected to increase significantly over a number of years to a level that the overall profitability of the business could be threatened. The current purchasing specifications did not prioritize the higher-priced engines with higher fuel efficiency. It is not the purchasing department's role to increase the corporate spend.

Although it was never mentioned during the Wal-mart initiatives or since, when reviewing the decisions through an Enterprise Risk Management lens, the Wal-mart Board of Directors could have identified the increasing fuel costs as an enterprise-wide risk. If this risk was perceived to be above the risk tolerance, then risk treatments would be considered. One option would be to ignore the risk. Another option would be to seek longer-term fuel futures contracts. Then subsequently, an option that was selected was to implement a corporate-wide effort to reduce fuel consumption and related costs.

Wal-mart considered the total cost of ownership and then increased the specification of the truck engines they were procuring. The purchasing function received a bigger budget to pay for the higher-priced engines, and the fleet operations had their fuel budget reduced a similar amount. The costs were incurred in one operation (purchasing), and the benefits were incurred in a different business operation (fleet operations). Purchasing and fleet operations were connected in a joint operation where collaboration led to enterprise-wide success.

It is reported that over a multi-year period, diesel fuel prices did go up 25%, but due in part to the sustainability projects, the Wal-mart fuel consumption costs stayed the same or decreased. A key is that even at a break-even return on investment, Wal-mart benefited because it was estimated their competitors' fuel prices went up the full 25%. Wal-mart received other benefits of a reduced number of shipments needed to support the same amount of business. At a public meeting, a Wal-mart Supply Chain Logistics Senior Manager jokingly complained that the massive increase in efficiency caused a problem of them having to find a place to store all the empty and idle company-owned trailers.

For food fraud prevention, there may not be an as direct and quantifiable benefit in a traditional "ROI" sense, but total quality management analysis can be applied to focus on the critical control points that have a much lower "fraud opportunity." Food fraud should be considered in an enterprise risk assessment and the vulnerability judged in relation to the risk tolerance. If food fraud is not a single identified problem above the risk tolerance, it probably contributes to other issues of concern such as food safety incidents, maintaining brand equity, and the ability to implement new products successfully.

Supply Chain Documentation

For food fraud prevention, there are several key supply chain documents and primary concepts.

- ***Bill of lading or uniform bill of lading:*** "is the basic document utilized in purchasing transport services. It serves as a receipt and documents the products and quantities shipped. […] The information contained on the bill of lading determines all responsibilities related to timing and ownership [including when the invoice is to be paid" (Bowersox et al. 2002).
- ***Order notified export:*** "It provides that delivery not is made unless the original bill of lading is surrendered to the carrier. … Upon customer payment for the product, the credit institution [third party] releases the bill of lading [and ownership of the product]" (Bowersox et al. 2002).
- ***Freight bill:*** "is a carrier's method of charging for transportation services performed [such as delivering a truckload of product]. … The freight bill may be either prepaid [paid by sender] or collect [paid by receiver]" (Bowersox et al. 2002).
- ***Shipment manifests:*** "lists individual stops or consignees when multiple shipments are placed on a single vehicle" (Bowersox et al. 2002).

There are other documents which are specific to food or food safety (Fenoff and Spink 2016). A survey of food fraud industry experts found 35 different documents they deal with to conduct their operations. For food fraud prevention, these documents are statements of legal export/import, a statement about the product origin, a clarification of where ownership was transferred to the recipient, declaration of the specifications, declaration of the authenticity, and other tax or reporting requirements.

The five most common supply chain documents related to food fraud are listed below (Fenoff and Spink 2016):

- ***Certificate of analysis***: A certificate of analysis is a statement of the test results for the product or sample provided, including the test results, methods used, testing lab, as well as the date of the test and in the identification of the original batch (WHO 2002).

  - "The certificate lists the results and includes a final evaluation and the conclusions of the examination of one or more samples." "In accordance with [Good Manufacturing Practice regulations], the certificate can be used in lieu of testing by the manufacturer (except for the identification tests as a minimum requirement), provided that the reliability of the supplier's analysis is established by the periodic validation of the test results by appropriate means and, if feasible, by on-site audits of the supplier's capabilities."

- ***Credence attribute statements or certifications*:** A credence attribute statement is defined as confirmation or declaration of an attribute that a valuable aspect of the product that cannot be readily detected or evaluated such as organic, country of origin, fair trade, sustainably harvested, processing such as kosher or halal, or others.
- ***Bill of lading***: These are described above.
- ***Laboratory analysis test results***: These are the reports from specifically defined tests.
- ***Import and export documents***: These are described above.
  - ***For food fraud prevention***, they are a statement of legal export/import, a statement about the product origin, a clarification of where ownership was transferred to the recipient, and other tax or reporting requirements.

Other related and essential concepts include:

- ***Force majeure:*** These are "circumstances beyond anyone's control, such as natural disasters" (Bowersox et al. 2002).
  - ***For food fraud prevention***, supply agreements could be written to expand "force majeure" to a product that is determined to be illegal and seized by governments. In this case, the supply agreement could nullify the purchase and the requirement for the buyer to pay for the product. If the buyer corporate policy states suspected illegal product must be reported to the government, there might be a major reduction in the "fraud opportunity." This is due to the situation that if the product must be reported to the government, then the fraudster risks losing the costs to produce the entire shipment after a seizure, the fraudster would become publically identified during court proceedings as criminals, and this could also lead all their global shipments to be suspicious and subject to additional government scrutiny.
- ***Freight on board (FOB):*** this can either be paid by the buyer (FOB origin) or paid by the seller (FOB destination).
  - ***For food fraud prevention***, there is a lower fraud opportunity if the purchaser takes possession of the product at FOB origin since there is more control of the supply movement and traceability.

There are other customs or financial documents that meet other details or needs. ***For food fraud prevention,*** there should be an awareness of how and where fraudulent documents can allow fraudulent products to enter the supply chain.

Key Learning Objective 2: Supply Chain Characteristics

This section will cover the complexity of supply chain management and systems to organize, manage, and protect the flow of material goods.

The Key Learning Objectives of this section are

- (1) Understand the impact and risks of the globalization of commerce.
- (2) Explore traceability, electronic transactions, and e-commerce.
- (3) Implement food fraud prevention in the supply chain.

Globalization

The World Health Organization (WHO) defines ***globalization*** as "…the increased interconnectedness and interdependence of peoples and countries, is generally understood to include two inter-related elements: the opening of international borders to increasingly fast flows of goods, services, finance, people and ideas; and the changes in institutions and policies at national and international levels that facilitate or promote such flows. Globalization has the potential for both positive and negative effects on economic development and health" (WHO 2018).

To consider the supply chain management complexity, it is estimated that 90% of global demand for goods are *not* covered by local supply (Bowersox et al. 2002). There are many reasons for globalization including the enabling of more efficient production being shifted to areas with optimal natural and human resources. Globalization enables a bigger economic scale of manufacturing which also lowers costs due to being near raw materials supply, low-cost labor, and reduced manufacturing costs due to high-volume production. Production can be concentrated because the output can be moved farther and faster around the world. Each economy relies on the products being able to move quickly across borders. "In addition to the sales potential, involvement in global business is being driven by significant opportunities to increase operating efficiency." The efficiencies include being able to strategically source raw materials, labor cost advantages in developing nations, and favorable tax laws for value-added operations (Bowersox et al. 2002).

From Bowersox, Closs, and Cooper (2013), the "logistics of internationalization" involve four considerations "plus one" (the term logistics is referring to challenges of organizing not the process of managing products through a supply chain) (Bowersox et al. 2002):

Logistics (Challenges) of Internationalization:

(1) **Distance:** how far the product moves from production to user.
(2) **Documentation:** more complex coordination of the record of the transactions.
(3) **Diversity:** differences in the work practices, cultural norms, laws and regulations, and general operating environment.
(4) **Demand:** differences in product preferences in different markets.

(5) **Defense ("plus one"):** an additional consideration is defined as security and specifically here to address terrorism. This could expand to include all types of intentional acts including those such as terrorism that has intent to harm but expand to others such as disgruntled employees, malicious tampering, and sabotage. Another intentional act is product fraud conducted for economic gain—while there may not be an immediate incident, an entire supply chain could be infiltrated and compromised.

For each of the four plus one considerations, there is an increased "fraud opportunity" which has examples noted here.

(1) **Distance fraud opportunity:** there are more transfers of products and less of a direct relationship from the manufacturer to the user.
(2) **Documentation fraud opportunity:** there is more of a reliance on the statements about the product rather than direct control to the point that many transactions are only digital.
(3) **Diversity fraud opportunity:** there are regional, industry, social, or socioeconomic norms that differ around the world—a practice that is commonplace and accepted in one market may not be understood or even be unknown in another. This difference in understanding of the norms can create confusion or problems.
(4) **Demand fraud opportunity:** there are regional, industry, social, or socioeconomic norms that differ around the world—a practice that could lead to a misunderstanding of terms, specifications, or what makes "common sense."
(5) **Defense fraud opportunity:** this is a specific awareness and understanding of the range of security issues that could lead to a disrupted or compromised supply chain from intentional illegal acts.

Globalization is an essential driver of economic growth. The changing and expanding volume of the movement of goods also presents emerging and evolving risks such as product fraud. A key point is to understand how the supply chain is changing and consider the shifting fraud opportunity. When there is an understanding of the shifting vulnerabilities, then efficient and effective countermeasures and controls systems can be implemented.

E-Commerce

A new and rapidly evolving supply chain innovation is electronic commerce or e-commerce. *E-commerce* is the use of the Internet, or electronic methods, to conduct sales transactions. The number of mobile phone technology users is booming worldwide, which—when combined with the use of electronic currency (e-currency; e.g., PayPal, ApplePay, SamsungPay, WeChat, QQ, and Bitcoin) and mobile phone application software or "APPs"—leads consumers to benefit from the efficiency of

ordering online. Whether the APP is an online order from a physical retail store or a direct-to-consumer retailer, the consumer is getting more and more product delivered to them rather than picking up the product at a retailer. Depending on the product and the geographic location, the product can be delivered by traditional parcel delivery services (e.g., United Parcel Service UPS, government mail systems, or other rapid delivery such as FedEx or DHL) or local couriers (e.g., bicycle or motorcycle delivery or other more local options). In places like Beijing, China, companies like Amazon.com have their own fleet of delivery vehicles such as trucks, tuk-tuks, motorcycles, and bicycles. In places such as New York City, companies such as Peapod have their own truck fleets.

Once consumers get setup and familiar with an e-commerce company or system, the convenience is easy and can even be addicting. Online shopping for clothes or consumer products has boomed as "Black Friday" shopping sales have expanded to include "Cyber Monday." Another example, why get up from your desk and walk to a coffee shop when one-click on an APP can have a latte delivered hot to your desk or your park bench. Also, the online ride-ordering services such as Uber and Lyft are providing many new mobile phone features such as being able to see a map of the drivers in your area and to see the wait time until pickup (which is easier than standing curbside waiting to hail a traditional taxi cab but not as easy as walking right up to a waiting taxi), there is a safety factor of your location and driver being monitored and recorded, and the transaction is cashless and even physical-interaction-less. So, consumers are becoming more and more confident and reliant on e-commerce. This has benefits but also significant drawbacks for food fraud prevention.

Some food fraud prevention concerns with e-commerce include (Spink 2016, 2017):

Food Fraud E-Commerce-Related Challenges:

- Not knowing exactly where the product is coming from (which could include a continuum from a national delivery service to a local courier).
- Not knowing how the product was handled or mishandled (such as a continuous cold chain or other contaminants).
- Not being able to sample or assess products before purchase.
- There is a lack of clarity on when the product—and legal responsibility—transfer to the end user (is the courier in contract with the end user or the seller? Is a trading platform such as Amazon.com, BestBuy.com when facilitating a nonproprietary marketplace transaction, or E-Bay, a participant in the transaction with legal responsibility?).
- There is a possible lack of supply chain and handling transparency across the different delivery options (you may order from one e-retailer, and the delivery may be conducted by multiple companies).

E-commerce is an immense opportunity for the marketplace, companies, and consumers, but there will need to be a tremendous amount of research to become aware of the evolving "fraud opportunity."

Sidebar: "Do you Think that Is Why Those Brokers Stopped Bidding on Our Business?"

Consider a hypothetical—but realistic—example where a company's purchasing volume required them to purchase through brokers, and during the implementation of their Food Fraud Prevention Strategy, the number of brokers bidding on their business decreased. While the exact reason could not be determined, it is possible that the increased awareness and discussion of food fraud—such as in the request for proposal RFP documentation and recommended training programs—scared fraudsters away. It is possible that the new food fraud prevention requirements led to fraudulent suppliers to decide not to bid on the proposal since they would risk getting caught.

For the company in this example, they bought a commodity ingredient and then adjusted their own operations to achieve a flavor profile. Whether they bought a fraudulent product or not, they were impacted by their cost of goods. On the other hand, if they labeled their product with details of the raw material (e.g., "Made in Michigan" when the ingredient was actually "Made in Illinois"), then not only would they be financially cheated but their finished good would be unintentional food fraud. Another misbranding problem would be if they made claims about the percentage or weight of honey in their product. Their finished goods would be illegal and subject to a product recall.

A primary concern by the company was that the procurement costs would increase due to fewer suppliers bidding on their business (Fig. 9.6). A statement from management was that "If we eliminate these suppliers then our costs will go up." This took a while for us to think about. There were two issues with a first concern about limiting their procurement options but then second a lack of awareness that their own product may be a violation of the

Fig. 9.6 Example of the impact of reducing the fraud opportunity on the cost of goods

FDCA Adulterated Foods or the Misbranded Foods Sections. Later, when reviewing the process in detail, since they were buying the commodity for the attribute, not just the weight, their total cost of goods should usually be the *same* with a *reduced* fraud opportunity and reduced overall enterprise-wide risk. For example, if they previously paid $1000 per 1000 pounds ($1/pound) and the product was diluted by 10%, they were really paying $1.11/pound of pure product. Also, they had an attribute quality specification in their own product (e.g., an amount of flavor), so purchasing the higher-priced pure product—which had a more intense flavor—also led them to use fewer pounds. While the previous operation may have needed to use 25 pounds of raw material per batch, to achieve the same flavor specification, they now only needed to use 22 pounds.

This example demonstrates the complicated and nontraditional thought process when dealing with food fraud. For most of the commerce, "laws are for the lawful," and generally, companies are trying to do the right thing. For food fraud prevention, the fraudsters intend to deceive and actively seek to avoid detection.

Sidebar: Early Supplier Involvement (ESI)

A supply chain management concept is "early supplier involvement" (ESI) (Zsidsin 2007). "ESI is a form of collaboration in which purchasing firms involve suppliers at an early stage in the product development cycle, often during the need recognition and description phases of the [supplier development procurement] acquisition process" (Zsidsin 2007). The relationship deepens when "Involvement becomes more significant as the supplier takes an active part in development processes by activities such as executing detailed drawings based on rough sketches provided by the purchasing organization" (Zsidsin 2007). While the major enterprise benefit is efficient operations and reduced operating or handling costs and a proactive focus, there can be benefits for food fraud prevention. An early focus on "total quality" can include systems and processes to reduce food fraud throughout the entire supply chain.

During the longer and more in-depth relationship building during the ESI process, the supplier and entire upstream supply chain will come under more scrutiny, and more efficient processes will be identified, implemented, and then refined.

By reviewing the "managerial implications," the additional benefits of ESI are identified (Zsidsin 2007):

- **Forming strong relationships:** This creates stronger relationships during the supplier selection process which increases the ability to "determine

(continued)

which suppliers will best be able to meet the specified outcomes in terms of quality, delivery, and cost and timeline goals." The early engagement can encourage suppliers to adopt more rigorous or efficient quality management programs such as fraud prevention.

  - ***For food fraud prevention***, this could include sharing of Food Fraud Vulnerability Assessments and Food Fraud Prevention Strategy plans.

- **Avoiding adverse selection and moral hazard:** The longer and deeper involvement in the ESI process creates a more thorough vetting of suppliers. "Moral hazard is reduced by having suppliers that either cannot meet up-front or are not willing to put forth the required effort to meet demand requirements are eliminated from further consideration early within the process" (for more on moral hazard, see the section on Dr. Kenneth Arrow).

  - ***For food fraud prevention***, an example is that suppliers who know—or suspect—their raw materials are fraudulent would most likely drop out of the program.

- **Transferring risk to suppliers:** Since the ESI process includes locking in agreements early, the buyer has some possible additional supply and price consistency. There is an increased benefit for the supplier to avoid budget overruns that often just get passed to the customer.

  - ***For food fraud prevention***, the risk of sloppy purchasing practices, or the cost of procuring fraudulent product, would be transferring the risk to suppliers. This transfer of risk to the supplier would reduce the fraud opportunity.

- **Developing supply chains:** With the increased involvement, there is an increased long-term business engagement, so marginal companies may evolve into "world-class" suppliers. The longer-term agreements could increase the confidence of a supplier to invest in training, methods, or equipment. This is a benefit to both the purchaser and supplier.

  - ***For food fraud prevention***, the longer and deeper relationship—combined with the thorough supply chain transparency—would reduce the willingness to commit fraud. An example would be suppliers who are encouraged and supported through higher-level standards and certifications such as the Global Food Safety Initiative. An example is the GFSI Global Markets Program which educates and trains small- and medium-sized enterprises.

In summary, adding fraud prevention to the early supplier involvement is efficient for the business and advances the overall benefits to both purchaser and supplier. The food fraud prevention tasks and benefits are secondary to the full relationship but can add value.

Key Learning Objective 3: Continuity Planning and Crisis Management

This section reviews the focus on keeping the operations going through continuity planning and crisis management.

The Key Learning Objectives of this section are
- (1) Overview of internal controls for SCM
- (2) Continuity planning and crisis management
- (3) The presentation of the Food Fraud Tabletop Exercise (FFTTX)

Internal Controls for Supply Chain Management

With the more complicated and complex supply chains, there is a need for more robust internal controls and an integrated framework (MSU-FFI 2017; MSU FFI 2017). ***Internal controls*** are defined as standardized methods or systems to monitor and manage operations (COSO 2013).

It is important to emphasize that "Enterprise Risk Management" is not an informal or general term. ERM is a concept defined in financial or managerial accounting regulations. The statement that an assessment is "Enterprise Risk Management" or "ERM" could be inadvertently making a legal or regulatory statement (COSO 2011). An informal risk aggregation—or "gathering a bunch of food risks"—is not ERM.

From ERM/COSO, the specific definition and scope that apply to the SCM questions (COSO 2013):

- ***Internal controls*** are defined as "A process, effected by an entity's board of directors, management, and other personnel, designed to provide reasonable assurance regarding the achievement of objectives in the following categories: effective and efficiency of operations, reliability in financial reporting, and compliance with applicable laws and regulations. An internal control system is a synonym for internal controls applied in an entity." This is "An effective system of internal control reduces, to an acceptable level, the risk of not achieving an objective relating to one, two, or all three categories of objectives."
- ***Integrated frameworks*** are defined as interconnectivity of internal controls to coordinate operations as well as provide an overall monitoring and calibrating system.

Supply chain management provides a vital role in the efficient management of a business. Information about supply, work-in-progress, sales, returns, and other inventory matters can be digital and can be automatically fed into an enterprise-wide system such as Enterprise Risk Management (ERM). The automatic, digital monitoring of the supply chain can be leveraged and also expanded to carry and analyze information about food fraud.

As food fraud prevention becomes a compliance requirement for food safety, such as for the Global Food Safety Initiative (GFSI) or the US Food Safety Modernization Act (FSMA), there is a more formal activity that will undoubtedly expand to ERM. Product fraud—including food fraud—is an enterprise-wide responsibility that can impact revenue and brand equity. Overall—including for the GFSI, related standards, and even regulation such as the US Food Drug and Cosmetics Act and the US Food Safety Modernization Act—addressing food fraud is *not* optional, so there will be more formalized analysis and reporting that can provide a clearer understanding of the extent of ERM/COSO compliance. This harmonized activity will also enable efficiency from the sharing of best practices and benchmark against conventional systems. Food fraud is being defined and researched as a specific type of enterprise risk. Food fraud prevention countermeasures and control systems are being analyzed in relation to ERM and presented on a corporate risk map.

Reviewing food fraud does *not* create a new risk. Food fraud is an ERM/COSO defined "inherent risk."

- An ***inherent risk*** is defined as "An effective system of internal control that reduces, to an acceptable level, the risk of not achieving an objective relating to one, two, or all three categories of objectives" (COSO 2013).

From a previous MSU Food Fraud Initiative Report (MSU-FFI 2017):
The Options for Addressing Food Fraud:

- (1) Ignore the risk and "hope for the best."
- (2) Implement Food Fraud Prevention Strategy.
- "*Not* being proactive can destroy a company and be a felony crime" (MSU-FFI 2017).

The Board of Directors—in addition to Sarbanes-Oxley Act reporting requirements—hold the C-suite accountable and responsible for addressing all risks whether they are currently known or not. The accountability and responsibility for inherent risk are one of the main drivers for implementing a food fraud prevention system that applies to all types of fraud, to all types of products, and that integrates into the enterprise-wide assessment system.

Business Continuity Planning and Incident Management

Business continuity planning (BCP) is a critical part of business controls including how to respond to an incident. BCP is a more positive term for "crisis management." This can be reviewed or practiced in a mock incident review or tabletop exercise (Brindley 2017).

Business Continuity Planning (BCP) Components:

- (1) Create system awareness.
- (2) Prevent supply chain disruptions.

- (3) Remediate supply interruptions.
- (4) Manage knowledge.

In BCP, there is a focus on understanding and embracing the "uncertainty of supply," especially with regard to events that could not have been foreseen. However, there may be circumstances where risk can be identified a priori ["theoretical deduction not from empirical evidence" (Black's 2014)] (Brindley 2017). In food fraud prevention terms, this would be identifying and addressing vulnerabilities (that have not occurred… *yet*) in addition to risks (have occurred, known).

For food fraud prevention, one way to increase the awareness and concern regarding food fraud is to propose a BCP Mock Incident. There are several actual incidents that have a lot of public details about the event and the costs including legal or regulatory penalties. Several incidents should address different types of food fraud that had supply chain-stopping power, for example, horsemeat in beef (an adulterant substance of high quality and safety but illegal mislabeling), date-code tampering (initially a McDonald's alleged incident in China but now also the widely publicized "2 Sisters" incident in the UK), stolen goods (either the stolen goods reentered into commerce or the remainder of the lot), or mislabeled product donated to a nonprofit but reentered into commerce (labeling error then the product philanthropic donation for export but some of the product reentered the US market).

Continuing the focus on BCP, food fraud is one type of "supply disruption." "It is impossible to eliminate the risk of supply chain disruption totally; however, it is critical to have a plan in place to deal with the disruptions when they occur" (Brindley 2017). The most basic supply disaster recovery planning includes questions such as (Brindley 2017):

1. "Is there an emergency disaster/business recovery/business continuity plan established in the supplier company?" [Then, does it include food fraud?]
2. "Is the plan deployed according to all existing sites?"
3. "In the case of disaster are there procedures to restart minimum service levels and to organize transport to a backup site?"

The recovery plan is as important as the prevention focus since subsequent incidents or product recalls can occur from well-meaning individuals who creatively try to address the crisis. There should be clear standard operating procedures and approvals for any variation in the food production or handling.

Mock Exercise: Food Fraud Tabletop Exercise (FFTTX)

There is often debate whether food fraud prevention and incident response are addressed in existing methods or programs. One way to test this is to conduct a mock incident response or mock product recall. If the methods and programs are

successful, then this is evidence of a working system. More times than not, addressing food fraud is very different from other incidents or product recalls, and the tabletop exercise defines the need to modify the management and business continuation plan (BCP).

Before conducting a tabletop exercise, it is essential to get an agreement on the scope of all food fraud which can be based on FSMA, GFSI, or other regulations or standards. After the scope is defined, it is recommended to start with previous, publically known incidents such as melamine in skim milk powder, horsemeat in beef, and peanut allergen shells in cumin. In addition it is good to choose several incidents that do not have a public health threat, but that undoubtedly could lead to a product recall such as country of origin labeling fraud (e.g., incorrect country of origin on the label), credence attribute (e.g., kosher or organic), and stolen goods (e.g., that have been reintroduced into commerce by the criminals so without confirmation of following Good Manufacturing Practices).

An example of a Food Fraud Tabletop Exercise (FFTTX) is the "Something's Fishy" project that was funded by the US Food and Drug Administration to the Michigan Department of Agriculture and Rural Development (MDARD) in collaboration with the Michigan State University's Food Fraud Initiative (MSU-FFI 2015). The FDA FREE-B program provides training for food defense-focused themes (FDA 2015). "The Food Related Emergency Exercise Bundle (FREE-B) is a compilation of scenarios based on both intentional and unintentional food contamination events (FDA 2015). It is designed with the intention of assisting government regulatory and public health agencies in assessing existing food emergency response plans, protocols and procedures that may be in place, or that they are in the process of revising or even developing" (FDA 2015). When originally funded by the FDA, the "intentional contamination" subject of economically motivated adulteration or food fraud was still within the scope. Later, the FSMA Intentional Adulteration Final Rule narrowed their focus to "wide-scale human health harm" (21 CFR 121; FSMA 2016). Thus, the current FREE-B website does *not* include the links to the "Something's Fishy" exercise.

An example of the value of the mock exercise is that it is based on real incidents and then provides some unexpected insight. Questions include:

- Is there a threat of violence against inspectors?
- When should law enforcement officers be involved?
- What was learned from the series of suspicious activity reports?
- What is the best practice for gathering information on food fraud?

One of the biggest surprises for the participants was the question of "At what point is the food inspector risking physical violence? There was a realization that we're not combating a microbe and the adversary is a human criminal."

Sidebar: Blog—Food Fraud Tabletop Exercise (FFTTX), "Something's Fishy" (MSU-FFI 2018)

Title: Grant Deliverable for FDA's Innovative Food Defense Program (IFDP)

By John Spink • March 1, 2018 • Blog

Attached you will find our "Something's Fishy" free and public Food Fraud Tabletop Exercise (FFTTX) that was the final deliverable for our 2013 FDA's Innovative Food Defense Program (IFDP) grant. Feel free to use the content as you see fit. The grant deliverables included submitting materials ready to be posted online in the FDA FREE-B program Food Related Emergency Exercise Bundle (FREE-B).

Project Update Report:

- December 2015: The FFTTX grant project was completed in September 2013. In 2015 the USA Food Safety Modernization Act (FSMA) "Intentional Adulteration" draft rule (FSMA-IA) defined the scope only to "catastrophic events." This covers terrorism and traditional FDA food defense scope as defined by HSPD-7 and -9. Specifically, FSMA-IA defined this section – and "food defense" – to cover only the very important and extremely complex concept of "catastrophic events" such as terrorism. FSMA-IA stated that "economically motivated adulteration," and thus food fraud, would be covered under the FSMA Preventative Controls rule (FSMA-PC), which is the traditional "food safety" type of hazard. Thus, food fraud/EMA is no longer under "food defense" and thus outside the scope of the "Innovative Food Defense Program." It is two years since we submitted the final report to FDA and we are not sure where – or if – it will be officially posted on FDA.gov. MSU and FDA are public institutions, and the FFTTX is subject to distribution via the Freedom of Information Act (FOIA). Thus we published the content on www.FoodFraudPrevention.com.

The Michigan Department of Agriculture and Rural Development (MDARD) and MSU partnered to propose and deliver this grant. The Principal Investigator was Brad Deacon from MDARD. Michigan State University was a subcontractor with Principal Investigator John Spink and Researcher Doug Moyer. The goal of the grant was to improve the understanding of food fraud and the roles and legal authorities of participants in a state's food emergency management plan.

From the grant proposal:

- Development and Implementation of Food Defense Tabletop Workshop Exposing and Mitigating the Vulnerability of Economically Motivated Adulteration and food fraud Incidents (PAR-12-116)

(continued)

- The development of the content and the tabletop exercise project is relevant to public health and counterterrorism since increasing the awareness of economically motivated adulteration and food fraud, is, itself, a public health benefit, but also would reduce future opportunities for malicious attacks. This project leverages theory leadership and strong relationships between the Michigan Department of Agriculture (PI: Deacon) and Michigan State University (PI: Spink with co-PI: Moyer). Furthermore, this will leverage current relationships and credibility with a broad range of stakeholders including GMA, IFT, IAFP, AFDO, Great Lakes Border Health Initiative, Michigan State Police, FDA, FBI, US Customs, and the GCC/SCC. The project will include the development of a Free-B exercise.

Live Tabletop Exercise: Pilot Event, States of Michigan & Minnesota, 2013

The development of the research project culminated in a June 2013 live tabletop exercise held in East Lansing, Michigan. There was a wide range of participants from multiple federal, state, and local agencies representing agriculture, food, public health, and law enforcement, as well as industry representatives. In addition to the more than 65 participants in Michigan, the exercise created a multi-State scenario by connecting on the phone in real time to public health officials in the State of Minnesota.

To create a realistic complexity the scenario involved product that was produced and transported between Michigan and Minnesota. Participants from the Minnesota Department of Agriculture and the FDA Minneapolis District Office worked in tandem with the Michigan team to produce an incident plan. This work included reviews of how the incident would be addressed by FDA's Rapid Response Team program.

The scenario included:

- "Bad Fish" found at a convenience store in Michigan
- Product distributed from a warehouse nearby in Michigan
- The product was Whitefish packaged in Minnesota

From the research, the key questions addressed were:

(1) Is there a threat of violence against inspectors?
(2) When should law enforcement officers be involved?
(3) What was learned from the series of suspicious activity reports?
(4) What is the best practice for gathering information on food fraud?
(5) For a food fraud suspicious activity or incident
(6) What would happen?
(7) What should happen?
(8) How can that be enabled?

One of the biggest surprises for the participants was the question of:

- "At what point is the food inspector risking physical violence? There was a realization that we're not combating a microbe and the adversary is a human criminal.

Live Tabletop Exercise: NEHA Convention, Nevada, 2014

Principal Investigator and MDARD Emergency Management Coordinator, Brad Deacon, received high praise when he conducted the FFTTX at the July 2014 National Environmental Health Association (NEHA) Convention. There were reportedly over 150 attendees.

This FFTTX scenario was intended to be a free and public document. Please feel free to use it as you see fit. Also, please let us know if you would like additional support or updated insight on food fraud. FFI

Course Materials with Links to Video Presentation Version:

Note: these are free, open, and available for anyone to use in any setting. The content is copyrighted which just means it does need to be correctly referenced.

Course Materials:

- Situation Manual (Instructor Guide): http://foodfraud.msu.edu/wp-content/uploads/2018/03/FFttx-situation.pdf
- Evaluator Form (Post Event Review): http://foodfraud.msu.edu/wp-content/uploads/2018/03/ffttx-evaluator.docx
- Presentation PowerPoint: http://foodfraud.msu.edu/wp-content/uploads/2018/03/FFTTX2-basic.pdf
- Videos (link to YouTube content – (contact us if your network does not allow access to YouTube.com):
  - Title (6 minutes): https://youtu.be/0WDDOvyg-9A
  - Grant Detail (12 minutes): https://youtu.be/nmCSlunDUlU
  - Food Fraud Overview (16 minutes): https://youtu.be/JaU9DOaUgZk
  - Law Overview (9 minutes): https://youtu.be/woXbKrXfFOk
  - Module1 Pre-Incident (5 minutes): https://youtu.be/syibQHfLm1o
  - Module2 Early-Incident (4 minutes): https://youtu.be/8eqGA-2hbX0
  - Module3 Late-Incident (4 minutes): https://youtu.be/mGP8NXKygsM
  - Module4 Aftermath (3 minutes): https://youtu.be/baJjcxL6K8Y
  - Closing Remarks and Next Steps (9 minutes): https://youtu.be/3Uc0I976oYE
  - Appendix: Industry Activities and Direction (12 minutes): https://youtu.be/1acuPA1TJ9o
  - Appendix: Marketing Notice Overview (8 minutes): https://youtu.be/1ziUS9_FX3k

Conclusion

Addressing food fraud is based on the goal to reduce often unknown and unquantified—and possibly unquantifiable—possible future costs. Supply chain management has evolved to include data analytics that addresses these types of problems including to identify and quantify very minute nuances that result directly in millions of dollars of savings. ***The first conclusion is*** that Supply Chain Management is a thorough and robust field of study that provides vital tools and strategies to manage and reduce the fraud opportunity. The range of SCM topics expands from identifying the structure and the documentation, but also to the management of those systems. ***The second conclusion is*** that food fraud prevention is a unique and complex Supply Chain Management consideration. The emerging study of food fraud prevention—and more broadly on all product fraud—is consistent with the SCM principles of quality management, data organization, and the general business practices such as ERM/COSO. ***The final conclusion is*** that there is an opportunity for further collaboration or integration of food fraud prevention with concepts SCM. The further collaboration will increase the efficiency and effectiveness of reducing the fraud opportunity which will also increase the supply chain efficiency.

Appendix: WIIFM Chapter on Supply Chain Management Fundamentals

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	SCM is a valuable and thorough science that provides critical insight and support of a robust Food Fraud Prevention Strategy
Quality team	SCM is a science that can be leveraged to increase the understanding and transparency for the supply chain, while both are utilizing current transactional relationships but also to coordinate a reduction of the fraud opportunity
Auditors	The SCM concepts provide indirect "supply chain controls" that can vastly reduce the fraud opportunity— – though once set up, the time and effort required should be very low
Management	To optimize enterprise-wide risk reduction efforts, it is critical to integrate SCM and quality management programs and activities. SCM and QA should be interacting both in the incident response activities but also highly integrated for strategic risk reduction and control
Corp. decision-makers	Project proposals should include insight and coordination between many business functions including SCM

Appendix: Study Questions

This section includes study questions based on the Key Learning Objectives in this chapter:

1. Discussion Question
   (a) Why is "supply chain management" a separate business area of study?
   (b) Why has it been a challenge for SCM to prioritize and address FF?
   (c) How does "business continuing planning" and "crisis management" address FF?
2. Key Learning Objective 1
   (a) What is "supply chain management" science?
   (b) How does supply chain management relate to all other business disciplines?
   (c) What are examples of strategic, tactical, and operational FF prevention?
3. Key Learning Objective 2
   (a) What is globalization?
   (b) What are the challenges for FF prevention presented by globalization?
   (c) How does ESI inherently reduce the fraud opportunity and how could it sometimes be dangerous?
4. Key Learning Objective 3
   (a) What is "business continuity planning"?
   (b) Why is food fraud an "inherent risk" and not just a "new risk"?
   (c) When addressing food fraud, at what point is there a threat of violence against auditors or inspectors?

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