FoodQuestTQ

The TQ stands for threat quotient

2012 REPORT CARD FOR FOOD PROTECTION: IS PERFORMANCE MEETING EXPECTATIONS?

The purpose of the paper is to set forth a possible framework and specific benchmarks against which quantitative data can be collected and analyzed to determine the true performance of industry and government in creating a safer food supply. This paper uses anecdotal information to assess U.S. Government and industry performance in creating a safer food supply across seven benchmarks of performance: 1) deterring the incidence of food borne poisoning; 2) detecting contaminated foods; 3) communicating possible threats of contaminated food; 4) delaying the potential for the ingestion of contaminated foods until an effective response is mustered; 5) the timeliness of responses to potential food poisonings; 6) the quality of those responses, and; 7) mitigating actions taken by industry and the government to ameliorate the future incidence of food poisonings. The 2012 levels of government and industry performance across the seven performance factors are graded on a scale from A to F. The paper concludes with several recommendations on how to strengthen government and food industry performance in making the food supply safer.

Food DefenseTQ Technical Paper No. 6

February 2013

2012 Report Card for Food Protection: Is Performance Meeting Expectations?

Technical Paper No. 6

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Executive Summary

Much of the information used in this paper to grade U.S. government and industry performance in creating a safer food supply is anecdotal since it does not represent up-to-date confirmed scientific data collected against specific performance benchmarks. ***The lack of current reporting requirements against specifically defined performance benchmarks represents a significant limitation in quantitatively deriving levels of industry and government performance in creating a safer food supply.***

The performance of government and industry to create a safer food supply were benchmarked across the 7 categories of performance and 23 associated criteria set forth in Figure 1, below. Levels of government and industry performance in each of the seven categories and associated criteria were graded on a scale from A to F. In the absence of current quantitative performance data provided by government and industry, we used government reports, media reporting of high profile incidents, professional articles and food industry media reporting to gauge levels of performance. ***For 2012, industry and government efforts to create a safer food supply received an average overall grade of a C on a scale of A to F based on available data and information.***

Category of Interest	Grade	Areas of Concern	Grade
1. Deterring the incidence of food borne poisoning	C	a) Shift to science and risk based standards	C-
		b) Timeliness and quality of government inspection	D
		c) Efforts to educate consumers	B+
2. Detecting contaminated foods	C	a) Identification of contaminated food products	C-
		b) Reduce the risk of consumption	C+
		c) Interdict consumption	C-
3. Communicating possible threats of contaminated food	C-	a) Timely notification of consumers	D
		b) Timely downstream notification of customers	C
		c) Timely upstream notification of suppliers	C
		d) Timely notification of government authorities	B
4. Delay to give responders the time they need to effectively respond	C	a) Inform the Consumer	C
		b) Make a "Recall" No Recall" Decision	C
		c) Determine the Scope of a Recall	C-
5. The timeliness of responses to potential food poisonings	C	a) Traceability Records	C-
		b) Recall Management	C
		c) Logistical Support	C
6. The quality of responses	C	a) Identify Product	C-
		b) Inform the Consumer	C
		c) Comprehensive Traceability Records	B-
		d) Recall Training and Testing	C
7. Mitigating actions taken to ameliorate the potential for future food poisonings	D	a) Nature of R&D Investments	D+
		b) Tangible Results	D
		c) Planning for Future Government Investments	D

Figure 1: 2012 Food Industry and Government Report Card

The report identifies four findings of general significance.

Finding	Report Observation
1. No set of common standards or criteria to guide the protection the food supply exists.	Instead, there are numerous government and industry schemas, all with different risk countermeasures, that are used by different food companies along the food supply chain at different locations across the globe.
2. Government and industry are not using scientifically derived measures to judge their food protection performance.	Methods are currently available to scientifically quantify the value of food protection risk reduction performance measures but they are not being used by the government or the food industry.
3. Industry and government do not use a systems approach for gauging the performance of the food protection system.	Without a systems approach you cannot establish an effective framework for the collection and analysis of the specific information you must have to gauge the performance of the food protection system.
4. The types of information and data required to quantitatively evaluate industry and government food protection performance is not being collected or analyzed.	Government and industry have not systematically developed food protection performance benchmarks and the data keeping, collection and analysis requirements necessary to evaluate their actual performance on creating a safer food supply.

Figure 2: Findings of General Significance

The report identifies ten additional findings by category of interest.

Category of Interest	Additional Findings
Deterring the incidence of food borne poisoning	1. The government and industry continue to rely on non-science and non-risk based methods to protect the food supply.
	2. The timeliness, quality and focus of government inspections are deficient.
	3. Government efforts to educate consumers in the safe handling of food are effective.
Detecting contaminated foods	4. Government and industry have the scientific and technical means to make more informed decisions to identify contaminated food product but they do not fully utilize them.
Communicating possible threats of contaminated food	5. In the food industry today, interdiction of consumption begins almost exclusively with the first report of illness or death. By the time affected consumers "get the message" they may be sick, dying or dead. The current system remains reactive rather than preventive.
Delay to give responders the time they need to effectively respond	6. Current efforts by the government and industry to reduce the time between suspecting that something might be wrong with a food product and taking the actions necessary to prevent consumer illness and death requires improvement.
The timeliness of responses to potential food poisonings	7. The timeliness of downstream and upstream notification requires improvement.
The quality of responses	8. Recall training and testing requires improvement.
Mitigating actions taken by industry and the government to ameliorate the consequences of food poisonings	9. There is a significant lag time between investments in food related university research and the emergence of practical food safety solutions that can be applied by the food industry.
	10. Current planning for future government investments to make the food supply safer lack the focus necessary to produce tangible near term results.

Figure 3: Additional Findings by Categories of Interest

The report identifies four recommendations of general significance.

Government and Industry Need	Recommendation
1. Common food protection standards.	Utilize available technology and quantify the value of food protection standards and criteria to create a common set of high prevention and response value food protection standards.
2. Scientifically derived risk based food protection measures .	Better utilize the scientific method and use risk management methods as you create a common set of high prevention and response value food protection standards.
3. A systems approach to guide the collection and analysis of the right data and information food protection needed to gauge system performance.	Adopt a systems approach that considers prevention and response and across the food threat and risk continuum.
4. The collection and analysis of data and information to quantitatively evaluate performance.	Establish data keeping, collection and analysis requirements in order to gauge performance.

Figure 4: Recommendations of General Significance

The report identifies seven additional recommendations by category of interest.

Category of Interest	Additional Recommendations
Deterring the incidence of food borne poisoning	1. Take the development and use of science and risk based food safety and food defense countermeasures seriously by using quantitatively derived measures of actual performance.
	2. Use these quantitative measures of performance to better focus the objectivity and validity of assessments and audits in order to reduce the required frequency of government oversight inspections.
Detecting contaminated foods	3. Make more informed decisions by placing greater emphasis on better and more frequent testing of ingredients and food products at all stages of the food supply chain to identify contaminated food product before it reaches the consumer.
Communicating possible threats of contaminated food	
Delay to give responders the time they need to effectively respond	4. Reduce the time between suspecting that something might be wrong with a food product and taking the actions necessary to prevent consumer illness and death.
The timeliness of responses to potential food poisonings	5. Continue to increase investments in traceability, recall management and the testing of recall management systems. This recommendation applies especially to small and medium businesses.
The quality of responses	
Mitigating actions taken by industry and the government to ameliorate the future potential of food poisonings	6. Better leverage the land grant university system to conduct highly focused programs of basic scientific research involving the biological contamination of food as dictated by actual industry needs.
	7. Place greater emphasis on technology innovation and the applied research necessary to address specific industry needs based on the use of quantitative performance benchmarks.

Figure 5: Additional Recommendations by Category of Interest

Introduction

The Complexity Systems Management Method (CSM Method®) is a patented systems model for understanding how things, regarded as ***systems***, influence one another within a whole. Using the CSM Method, systems are understood by examining the linkages and interconnections among the different elements that compose the entirety of the food protection system.[i] Food protection systems include both food safety and food defense risk countermeasures.

Any food protection system shares the two common goals of ***preventing*** and, when necessary, ***responding*** to untoward events. There are seven distinct elements of a food protection system known, in CSM Method parlance, as the food threat and risk continuum.

Thinking about food protection using the seven elements of the food threat and risk continuum allows you to quantify the performance of a food protection system and the relative value of food safety and food defense risk countermeasures.

The first element of the food threat continuum is ***deterrence.*** Deterrence means the actions that we take to discourage people from intentionally or accidentally contaminating food.

CSM Method®: Threat Continuum for Food	
1. ***Deterrence*** means the actions we take to discourage people from intentionally or accidentally contaminating food	
2. ***Detection*** means learning about an intentional or accidental poisoning early enough so that you can communicate an alarm to those people who are in the position to respond to the incident	
3. ***Communication*** means sounding an alert to responders to come to your assistance	
4. ***Delay*** means the actions taken to reduce the risk of an intentional or accidental poisoning while awaiting a response	Food Defense: The physical barriers in place to slow the adversary down long enough for a sufficient number of responders to arrive on the scene in order to interdict the incident
	Food Safety: Promptly taking the precautionary measures necessary to stop the further distribution of contaminated food, inform the consumer not to eat contaminated food product and any other actions to reduce the potential risk to food products and consumers
5. ***Response Time*** means the actual elapsed time from the sounding of an alert and the actions of responders	Food Defense: The actual elapsed time from a communicated alert to the time responders arrive on scene to interdict an adversary.
	Food Safety: The actual elapsed time from a communicated alert to the time responders take action to ameliorate the consequences of an event
6. ***Response Quality*** means how effectively responders do their jobs	
7. ***Mitigation*** means the measures that are taken to ameliorate the potential for future intentional attacks or accidental poisonings	

Figure 6: The Food Protection Threat Continuum

The second element of the food threat continuum is ***detection***. Detection means learning about an intentional or accidental poisoning early enough so that you can communicate an alarm to those people who are going to respond to the incident. The third element of the food threat continuum is ***communication***. Communication means sounding an alert for responders to come to your assistance.

The fourth element of the food threat continuum is ***delay***. In the case of an intentional attack against the food supply, delay constitutes the physical barriers that are in place to slow down the adversary down long enough for a sufficient number of responders to arrive on scene in order to interdict the adversary. For example, a locked door will provide greater delay time than an unlocked door.

In the case of accidental poisoning, delay constitutes promptly taking the precautionary measures necessary to stop the further distribution of contaminated food, inform the consumer not to eat contaminated food product and any other actions that reduce the potential risk to consumers. For example, the decision to stop potentially contaminated shipments of food products and prompt public announcements of potentially contaminated food product are two of many actions that could be taken to reduce the risk that consumers will ingest poisoned food while awaiting a full scale response.

The fifth element of the food threat continuum is ***response time***. Response time means the actual elapsed time from the sounding of an alert to the time responders take action to prevent an incident from escalating. In the case of an intentional attack against the food supply, response time constitutes the actual elapsed time from a communicated alert to the time responders arrive on scene to interdict the adversary. In the case of accidental poisoning, response time constitutes the actual elapsed time from the sounding of an alert to the time responders take actions to ameliorate the consequences of the event.

The sixth element of the food threat continuum is ***response quality***. Response quality means how effectively responders do their jobs of preventing an incident from escalating. The seventh element of the food threat continuum is ***mitigation***. Mitigation means the measures that are taken to ameliorate the possibility of future intentional attacks or accidental poisonings.

In this paper we use the CSM Method to establish a ***systems*** approach for grading the food protection performance of government and industry. Performance is gauged across the 7 major categories of interest and the 23 specific areas of related concern as depicted in Figure 1 on page 1 of this paper. Levels of government and industry performance are graded on a scale from A to F where A means a score of 90-100%; B means 89-80%; C means 79-70%; D means 69-60%, and; F means 59% and below.

Using the CSM Method systems model for food protection and the above grading scheme we derived both prevention and response values across the applicable categories of interest and related areas of related concern (see Figure1). For example, as depicted in Figure 7, below, if we can a) discourage someone from intentionally or accidentally poisoning food, i.e., deterrence; b) discover the incident soon enough to stop it from escalating, i.e., detection; c) quickly alert responders about the problem, i.e., communicate; d) take actions to reduce the potential for the ingestion of contaminated foods until a full scale response can be mustered, i.e., delay; e) respond quickly enough to stop the incident from escalating, i.e., response time, and; f) respond effectively, i.e., response quality, then we are in the position to interdict events before they escalate, i.e., prevention. In CSM Method parlance, this is known as the ***probability of interdiction***.

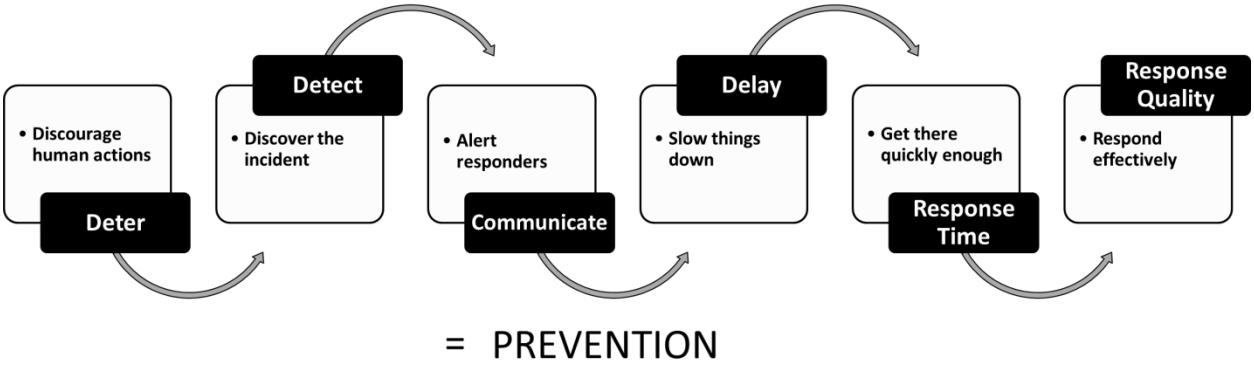

Figure 7: Preventing Food Protection Incidents and the Probability of Interdiction

Using the CSM Method systems model for food protection and our grading scheme, we also derived response values, i.e., grades, across the applicable categories of interest and related areas of concern (see Figure1). For example, as depicted in Figure 8, below, if we a) respond quickly enough to stop the incident from escalating, i.e., response time; b) respond effectively, i.e., response quality, and; c) ameliorate the consequences of an incident, i.e., mitigation, then we are in the position to respond to events in a way that reduces consequences and prevents future incidents.

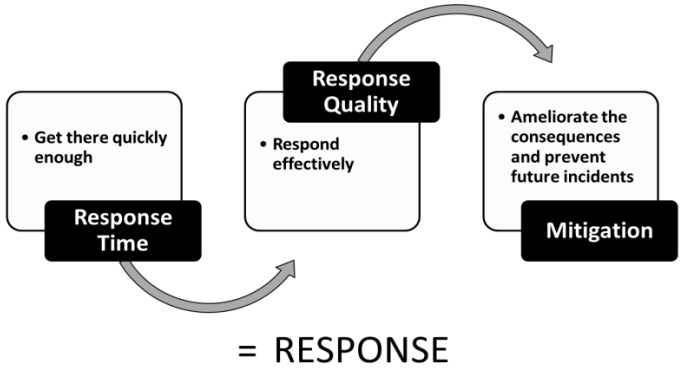

Figure 8: Responding to Food Protection Incidents

Grading Food Protection System Performance

The author concludes that almost all of the information available to grade the performance of government and industry is anecdotal because it does not represent confirmed or current data collected against specific performance benchmarks. The lack of quantitative data and information for the specific benchmarks of performance represents a significant limitation in deriving objective levels of industry and government performance in creating a safer food supply. The absence of quantitative performance data means that the "grades" assigned to industry and government may be biased by the nature of government, industry, media reporting and the age of the data or information itself. Frequently, we found the issuance of highly critical government reports in past years with no indication of successful

closure on their findings. Thus, the underlying purpose of this paper is to propose a framework for government and industry to consider that will encourage the continuous reporting of performance against quantitative scientifically derived benchmarks. Without a solid baseline of performance and the up-to-date quantitative scientific data to support it, the performance of government and industry efforts to create a safer food supply will remain the subjective art it has traditionally been rather than the science and risk based endeavor it must become.

To obtain direct inputs from food protection practitioners, this paper is accompanied by a web-based survey that allows practitioners to "grade" industry and government performance across the seven performance benchmarks used in this paper based on their own experience. The survey can be accessed at: https://www.surveymonkey.com/s/JBC96WC. Readers are invited to share their opinions with respect to the performance of industry and the government by completing the short survey. We will issue a subsequent publication showing how the results of the survey compare with the results presented in this paper.

The assessment results presented in this paper are generalized and include the Food and Drug Administration, the U.S. Department of Agriculture and the estimated 175,000 small, medium and large food companies (not including small farms) operating in the United States. We recognize that many food companies may excel in addressing the criteria used to benchmark their food protection performance in this report while others may not.

For purposes of this analysis, ***deterrence*** means the actions being taken by the Food and Drug Administration and the U.S. Department of Agriculture to regulate the food industry by: 1) the use of science and risk-based methods; 2) the timeliness and quality of government inspection, and; 3) efforts to educate consumers in the safe handling of food.

Shift to Science and Risk Based Standards	Timeliness and Quality of Government Inspection	Efforts to Educate Consumers	Average Grade for Deterrence
C-	D	B+	C

Figure 9: Performance of the Industry and Government in Deterring the Contamination of Food

The results of the assessment found that government and industry are slow to adopt science and risk based methods to protect the food supply.[ii] Instead, the government continues to pursue a "one size fits all" solution for small, medium and large food companies. The problem is being exacerbated by the food industry itself. Some companies, instead of raising the science and technology bar on their own to improve the safety of the products they sell, defer to the government in the mistaken belief that their companies can save money by meeting a lower regulatory compliance standard when, in fact, the opportunities to increase cost efficiencies by moving to science and risk based standards are much greater than the current approach.[iii]

The timeliness and quality of the government inspection process requires improvement. Government inspections of the food industry continue to rely primarily on the subjective application of largely non-

science and non-risk-based regulatory standards developed using the same qualitative processes that have existed in the United States since the turn of the 20th century. This problem is further exacerbated by the use of a third party audit system that relies on subjective evaluations of performance in the absence of science and risk based performance standards.[iv]

The assessment also found that government efforts to educate consumers in the safe handling of food are somewhat effective.[v]

Detection means actions by government and industry to: 1) identify contaminated food product; 2) take timely actions to reduce the risks associated with the consumption of the product by consumers, and; 3) interdict the consumption of the contaminated product by consumers.

Identify Contaminated Food Product	Reduce the Risk of Consumption	Interdict Consumption	Average Grade for Detection
C-	C+	C-	C

Figure 10: Performance of the Industry and Government in Detecting the Contamination of Food

The results of the assessment found that government and industry have the scientific and technical means to make much more informed decisions to identify contaminated food product but they do not use them. For example, large bulk testing at the beginning of the food manufacturing process with less or no effective testing of the manufactured product downstream.[vi] The assessment found that determining the risk associated with a specific food type and manufacturing process relies on scientifically valid testing protocols and their faithful implementation. If you do not sufficiently test for the possibility of contamination it is not possible to determine risk. In the food industry today, interdiction of consumption begins most frequently with the first report of illness or death. The current system remains reactive rather than preventive.

Communication means actions to quickly notify: 1) the consumer; 2) downstream customers; 3) upstream industry suppliers, and; 4) government authorities of contaminated or potentially contaminated food products before they are ingested by the consumer.

Timely Notification of Consumers	Timely Downstream Notification	Timely Upstream Notification	Timely Notification of Government	Average Grade for Communication
D	C	C	B	C-

Figure 11: Performance of the Industry and Government in Communicating the Contamination of Food

The result of the assessment found that interdiction of consumption begins most frequently with the first report of illness or death. Thus, the timeliness of downstream and upstream notification requires improvement. While industry may make prompt notifications to the government in the event of contaminated or potentially contaminated food products that result in consumer illnesses or deaths, they are largely made after people become ill and or die. Current efforts focus on containment of illness and death after the fact rather than prevention.[vii]

Delay means the actions taken by the government and the food industry, while awaiting a full scale response, to promptly reduce the risk of consumer poisoning by: 1) informing consumers of the possibility of contaminated product; 2) making "recall" "no recall" decisions, and; 3) determining the scope of a recall.

Inform the Consumer	Make a "Recall" No Recall" Decision	Determine the Scope of a Recall	Average Grade for Delay
C	C	C-	C

Figure 12: Performance of the Industry and Government in Delaying the Ingestion of Contaminated Food

The assessment found that the actions taken by industry and government to promptly reduce the risk of consumer poisoning, while awaiting a full scale response, i.e., delay, requires improvement. We reached this conclusion because the interdiction of consumption of contaminated product by consumers begins most frequently with the first report of illness or death. Thus, current efforts by the government and industry to take actions to reduce the risk that consumers will ingest poisoned food by promptly: 1) informing the consumer of potential threats; 2) making "recall" "no recall" decisions, and; 3) determining the scope of a recall require improvement. Because consumers are not informed until after the decision is made to recall a product, the threat of possible consumption remains very high until they are notified. Even after notification, the threat of possible consumption may remain high depending on the scale of distribution. The assessment found that the timeliness of making "recall" and "no recall" determinations are adversely influenced by multiple, often conflicting, and sometimes subjective risk factors including likelihood of possible deaths and severity of illnesses, the scope of product distribution, the cost-benefit analysis between recall in favor of litigation, impact on brand name and many other factors.[viii] The assessment also found that determining the scope of recalls is adversely impacted by complex interrelated supply chains that broaden the scope of product recalls.[ix]

Response time means the elapsed time from the determination to recall a product to the elimination of the threat of ingestion by a consumer including: 1) availability of traceability records; 2) recall management actions, and; 3) providing logistical support.

Traceability Records	Recall Management	Logistical Support	Average Grade for Response Time
C-	C	C	C

Figure 13: Performance of the Industry and Government in Making Timely Responses to the Ingestion of Contaminated Food by Consumers

The timeliness of responses to potential food poisonings is complicated by complex interrelated supply chains that broaden the scope of product recalls to include multiple companies and their suppliers.[x] The assessment found that while recent scientific and technological advances in the traceability of food products have been made they are not timely. The timeliness of recall management is marred by numerous high profile cases where government and industry delayed the implementation of large scale

recalls that later resulted in consumer illnesses and deaths.[xi] The timely availability of the logistical support necessary to quickly remove tainted product from the food shelf is a function of urgency. Actions by the government and industry to forestall "recall" "no-recall" determinations impact the urgency with which tainted or potentially tainted food products are removed from the food shelf.

Response Quality means the quality of actions taken to: 1) identify a specific product as a possible cause of food borne illness; 2) inform the consumer of the danger; 3) the comprehensiveness of traceability records; 3) the quality of training and testing of recall response teams.

Identify Product	Inform the Consumer	Comprehensive Traceability Records	Recall Training and Testing	Average Grade for Response Quality
C-	C	B-	C	C

Figure 14: Performance of the Industry and Government in Making Quality Responses to the Ingestion of Contaminated Food by Consumers

The result of the assessment found that interdiction of consumption begins most frequently with the first report of illness or death. While industry may make prompt notifications to the government in the event of contaminated or potentially contaminated food products that result in consumer illnesses or deaths they are largely made after the fact. The quality of recall efforts is marred by numerous high profile cases where government and industry delayed the implementation of large scale recalls that later resulted in consumer illnesses and deaths.[xii] The industry has made some progress since the passage of the Bioterrorism Act of 2002 to implement "one-up and one-back" traceability for food products, however, further improvement is required.[xiii] The assessment found that recall training and testing requires improvement.[xiv]

Mitigation means actions taken by industry and the government to ameliorate the potential for future intentional and accidental food poisonings. The benchmarks for this category of performance are: 1) the nature of government and industry investments in science-based technology solutions; 2) the tangible results of these investments in making the food supply safer, and; 3) government plans for science and technology investments to make the food supply safer.

Nature of R&D Investments	Tangible Results	Planning for Future Government Investments	Average Grade for Mitigation
D+	D	D	D

Figure 15: Performance of the Industry and Government in Mitigating the Consequences and Preventing Future Food Poisonings

The assessment found that because the government and industry use no systems approach to gauge their own performance against specific food protection system benchmarks, the investments being made to create a safer food supply lack necessary focus. The conundrum is that the significant investments being made cannot be focused on the solutions to specific industry problems that hold the

greatest potential for solving the problem. It is difficult for the government to make sound investments to solve problems unless they really understand what the problem is. The results of the assessment found that there is a significant lag time between investments in food related university research and the emergence of practical food safety solutions that can be applied by the food industry.[xv] The assessment also found that continuing large investments in the Land Grant University System to make the food supply safer are not producing enough tangible near term results because universities are not effective in commercializing products and they have a proclivity to conduct basic rather than applied research.

As depicted in Figure 16, below, using the CSM Method systems model for the protection of the food supply, industry and government efforts to ***deter*** intentional attacks and accidental poisonings received the average grade of a C indicating the need for improvement. Government and industry efforts for the early ***detection*** of intentional attacks and accidental poisonings received the average grade of a C indicating the need for improvement. Because current risk ***communication*** efforts focus on containment of illness and death after the fact, rather than prevention before the fact, industry and government were assigned a grade of C- indicating the need for improvement. The actions taken by industry and government to promptly reduce the risk of consumer poisoning while awaiting a full scale response, i.e., ***delay***, were given the average grade of C indicating the need for improvement. The ***timeliness*** of industry and government responses to potential food poisonings received a grade of C indicating the need for improvement. The ***quality*** of industry and government responses to potential food poisonings received a grade of C indicating the need for improvement. Because the government and industry use no systems approach to gauge their own performance against specific food protection system benchmarks, and the significant lag time between basic university research and the commercial development of technology to solve specified problems, a grade of D was assigned for efforts to prevent future intentional and accidental poisonings, i.e., ***mitigation.*** ***The assessment found that for 2012, industry and government efforts to create a safer food supply received an average overall grade of a C on a scale of A to F.***

Deterrence	Detection	Communication	Delay	Response Time	Response Quality	Mitigation	Average Grade
C	C	C-	C	C	C	D	C

Figure 16: Industry and Government Efforts to Create a Safer Food Supply

In Figure 7, on page 7, we illustrate the linkages and interconnections among the different elements of the food protection system that comprise prevention as the probability of interdiction. As depicted in Figure 17, below, using the CSM systems model, prevention is a function of the relationship among deterrence, detection, communication, delay, response time, and response quality. ***The assessment found that for 2012, industry and government efforts to prevent American consumers from becoming ill or dying as the result of eating contaminated food received a grade of C- on a scale of A to F.***

Deterrence	Detection	Communication	Delay	Response Time	Response Quality	Average Grade for Prevention
C	C	C-	C	C	C	C-

Figure 17: Industry and Government Performance in Preventing American Consumers from Becoming Ill or Dying as the Result of Eating Contaminated Food

In Figure 7, on page 7, we illustrate the linkages and interconnections among the different elements of the food protection system that compose response. As depicted in Figure 18, below, using the CSM systems model, response is a function of the relationship among response time, response quality and mitigation. ***The assessment found that for 2012, government and the food industry received a grade of C- for the effectiveness of responses to food poisonings.***

Response Time	Response Quality	Mitigation	Response Grade
C	B-	D	C-

Figure 18: Industry and Government Performance in Effectively Responding to Food Poisonings

Summary of Report Findings

Against the CSM Method systems model used in this paper to benchmark the performance of government and industry we have identified the four general findings depicted in Figure 19, below. Industry and Government have not come together around any set of common standards or criteria to guide the protection of the food supply. Instead there are numerous government and industry schemas that are used by different food companies at different sites along the food supply chain at locations across the globe. All too frequently, the food protection standards and performance criteria in use today do not reflect the scientific method or the principles of good risk management. To an outside observer it would appear that the world is engaged in a highly subjective standards war of large and unhelpful proportions.[xvi]

Finding	Report Observation
1. No set of common standards or criteria to guide the protection the food supply exists.	Instead, there are numerous government and industry schemas, all with different risk countermeasures, that are used by different food companies at different sites along the food supply chain at locations across the globe.
2. The government and industry are not using scientifically derived measures to judge their food protection performance.	Methods are currently available to scientifically quantify the value of food protection risk reduction measures but they are not being used by the government or the food industry.
3. Industry and government do not use a systems approach for gauging the performance of the food protection system.	Without a systems approach you cannot establish an effective framework for the collection and analysis of scientifically derived food protection risk reduction measures.
4. The types of information and data required to quantitatively evaluate industry and government food protection performance is not being collected or analyzed.	Government and industry have not systematically developed food protection performance benchmarks and the data keeping, collection and analysis requirements necessary to evaluate their actual performance on creating a safer food supply.

Figure 19: Summary of General Findings

Although technological breakthroughs now allow for the scientific quantification of food protection risk reduction measures[xvii] they are not being used by government or the food industry. The quantification of food protection risk reduction measures allows food companies to discriminate between "what works" and "what doesn't work" to guide the selection of the "best" and most cost effective food protection investments.[xviii]

In the absence of a systems model for the food protection system it is not possible to accurately judge government and industry performance in creating a safer food supply. While many food safety and food defense approaches such as HACCP and C.A.R.V.E.R. + Shock, respectively, are in wide use today it is not possible to scientifically prove or disprove their degree of effectiveness in creating a safer food supply in the absence of a systems model. This problem is exacerbated because the types of food protection performance data and information necessary to benchmark actual performance are not being collected or analyzed by industry or by the government using a systems approach.

Category of Interest	Additional Findings
Deterring the incidence of food borne poisoning	1. The government and industry continue to rely on non-science and non-risk based methods to protect the food supply.
	2. The timeliness, quality and focus of government inspections are deficient.
	3. Government efforts to educate consumers in the safe handling of food are effective.
Detecting contaminated foods	4. Government and industry have the scientific and technical means to make more informed decisions to identify contaminated food product but they do not fully utilize them.
Communicating possible threats of contaminated food	5. In the food industry today, interdiction of consumption begins almost exclusively with the first report of illness or death. By the time affected consumers "get the message" they may be sick, dying or dead. The current system remains reactive rather than preventive.
Delay to give responders the time they need to effectively respond	6. Current efforts by the government and industry to reduce the time between suspecting that something might be wrong with a food product and taking the actions necessary to prevent consumer illness and death requires improvement.
The timeliness of responses to potential food poisonings	7. The timeliness of downstream and upstream notification requires improvement.
The quality of responses	8. Recall training and testing requires improvement.
Mitigating actions taken by industry and the government to ameliorate the consequences of food poisonings	9. There is a significant lag time between investments in food related university research and the emergence of practical food safety solutions that can be applied by the food industry.
	10. Current planning for future government investments to make the food supply safer lack the focus necessary to produce tangible near term results.

Figure 20: Summary of Additional Findings by Category of Interest

Against the CSM Method systems model used in this paper to benchmark the performance of government and industry, we have identified the ten additional findings depicted in Figure 20, above. To deter the incidence of food borne poisonings we found three areas of concern. Government inspections of the food industry continue to rely primarily on the subjective application of regulations using the same qualitative processes that have existed in the United States since the turn of the 20th century. The timeliness and quality of government inspections require improvement. Government efforts to educate consumers in the safe handling of food are somewhat effective.

To detect contaminated food products before they are ingested by consumers, we found numerous high profile cases where the government and industry are aware of the scientific and technical means to make much more informed decisions to identify contaminated food products but they are not being

fully utilized. The assessment found that determining the risk associated with a specific food type and manufacturing process relies on scientifically valid testing protocols and their faithful implementation. If you do not sufficiently test for the possibility of contamination it is not possible to determine risk. In the food industry today, interdiction of consumption begins most frequently with the first report of illness or death. The current system remains reactive rather than preventive.

To communicate possible threats to consumers before they can ingest potentially contaminated food we found that interdiction of consumption begins most frequently with the first report of illness or death. Thus, the timeliness of downstream and upstream notification requires improvement. While industry may make prompt notifications to the government in the event of contaminated or potentially contaminated food products that result in consumer illnesses or deaths they are largely made after people become ill and or die. Current efforts focus on containment of illnesses after the fact rather than proactive prevention.

The assessment found that the actions taken by industry and government to promptly reduce the risk of consumer poisoning, while awaiting a full scale response, i.e., delay, requires improvement.[xix] The assessment found that the timeliness of making "recall" and "no recall" determinations are adversely influenced by multiple, often conflicting, and sometimes subjective risk factors. The assessment also found that determining the scope of recalls is adversely impacted by complex interrelated supply chains that broaden the scope of product recalls.

The assessment found that the timeliness of downstream and upstream notifications requires improvement. The assessment also found that while recent scientific and technological advances in the traceability of food products have been made they are not used in a timely fashion. The timely availability of the logistical support necessary to quickly remove tainted product from the food shelf is a function of urgency. Actions by the government and industry to forestall "recall" "no-recall" determinations impact the urgency with which tainted or potentially tainted food products are removed from the food shelf.

With respect to the quality of food protection responses, we found that consumers are often not informed of the potential danger of poisoned food until government and industry complete a deliberative process that frequently includes confirmation of the offending agent, an impact assessment and ultimate government pressure to force a recall. The industry has made significant progress since the passage of the Bioterrorism Act of 2002 to implement "one-up and one-back" traceability for food products, however, the traceability of food ingredients and finished products requires improvement. The assessment found that recall training and testing requires improvement.

Finally, we found that industry and government efforts to ameliorate the potential of future intentional attacks and accidental food poisonings are lacking. The bulk of research and development investments focus on basic university research not the delivery of commercial products that can produce near term tangible results in creating a safer food supply.[xx]

Recommendations

Against the CSM Method systems model used in this paper to benchmark the performance of government and industry, we have identified the four general recommendations depicted in Figure 21, below, for government and industry to consider as they move forward to create a safer food supply.

Government and Industry Need	Recommendation
1. Common food protection standards.	Utilize available technology and quantify the value of food protection standards and criteria to create a common set of high prevention and response value food protection standards.
2. Scientifically derived risk based food protection measures .	Better utilize the scientific method and use risk management methods as you create a common set of high prevention and response value food protection standards.
3. A systems approach to guide the collection and analysis of the right data and information food protection needed to gauge system performance.	Adopt a systems approach that considers prevention and response and across the food threat and risk continuum.
4. The collection and analysis of data and information to quantitatively evaluate performance.	Establish data keeping, collection and analysis requirements in order to gauge performance.

Figure 21: Summary of General Recommendations

Our first general recommendation is to adopt available technology to produce a common set of food protection standards that are scientifically vetted to determine "what works" and "what doesn't work." The technology to do this already exists and has been commercially applied to identify those food protection standards that have the greatest value in preventing food poisonings and enhancing responses to food emergencies. The technology can be quickly and easily adopted the food industry to enhance food protection performance while simultaneously reducing the costs of implementing both food safety and food defense programs.[xxi]

The second general recommendation is for government and industry to adopt a systems approach to protect the food supply that uses the food threat and risk continuum to determine performance benchmarks.

Third, we recommend that these performance benchmarks be integrally tied to those food protection standards that have the greatest value in preventing intentional and accidental food poisonings and enhancing responses to food emergencies to enhance performance while simultaneously reducing costs.

Fourth, we recommend that government and the food industry establish data keeping, collection and analysis requirements around each of the performance benchmarks identified using a systems approach.

Category of Interest	Additional Recommendations
Deterring the incidence of food borne poisoning	1. Take the development and use of science and risk based food safety and food defense countermeasures seriously by using quantitatively derived measures of actual performance.
	2. Use these quantitative measures of performance to better focus the objectivity and validity of assessments and audits in order to reduce the required frequency of government oversight inspections.
Detecting contaminated foods	3. Make more informed decisions by placing greater emphasis on better and more frequent testing of ingredients and food products at all stages of the food supply chain to identify contaminated food product before it reaches the consumer.
Communicating possible threats of contaminated food	
Delay to give responders the time they need to effectively respond	4. Reduce the time between suspecting that something might be wrong with a food product and taking the actions necessary to prevent consumer illness and death.
The timeliness of responses to potential food poisonings	5. Continue to increase investments in traceability, recall management and the testing of recall management systems. This recommendation applies especially to small and medium businesses.
The quality of responses	
Mitigating actions taken by industry and the government to ameliorate the future potential of food poisonings	6. Better leverage the land grant university system to conduct highly focused programs of basic scientific research involving the biological contamination of food as dictated by actual industry needs.
	7. Place greater emphasis on technology innovation and the applied research necessary to address specific industry needs based on the use of quantitative performance benchmarks.

Figure 22: Summary of Additional Recommendations by Category of Interest

Against the CSM Method systems model used in this paper to benchmark the performance of government and industry to create a safer food supply, we have identified seven additional recommendations.

To deter the incidence of food borne poisoning we recommend that industry and government take the development and use of science and risk based countermeasures seriously. Although the technology now exists to quantitatively derive measures of actual performance, government and industry are too slow in adopting it. We also recommend that government and industry adopt quantitative measures of performance to better focus the objectivity of assessments and audits in order to reduce the required frequency of government oversight inspections.

To more effectively detect contaminated foods and communicate the risk before they are ingested by consumers, we recommend that the food industry make more informed decisions about the food they ship to consumers by placing greater emphasis on testing food products at all stages of production along the food supply chain to identify contaminated food products before they reach the consumer.

To provide the delay responders need to effectively respond to the threat of potential poisoning of consumers we recommend that industry and government reduce the time between suspecting that something might be wrong with a food product and taking the actions necessary to warn consumers of the risk.

To enhance both the timeliness and quality of responses to threats of contaminated food we recommend that industry and government increase investments in traceability, recall management and the testing of recall management systems. This recommendation applies especially to small and medium businesses.

To improve mitigation by reducing the risk of future food poisonings we recommend that industry and government better leverage the significant investments that are now being made in the Land Grant University System. The role of the Land Grant University System should be limited to the conduct of the basic research necessary for the advancement of science. The role of applied research and the commercialization of tangible products needed by the food industry are much better suited to industry. As it stands now, the critical innovation that should be coming from small business to create a safer food supply is being lost because of government funded university grants that place universities in the position to compete directly with small businesses.

For many years, the defense industrial base has relied on the innovation of small business to conduct the applied research and the commercialization of the products necessary to solve the most difficult scientific and technical challenges. These programs have been highly successful. We recommend that the government agencies responsible for the protection of the food supply expand their programs of cooperation with small business around applied research and new product development in order to produce the tangible products in the short term to improve food industry performance. These programs of applied small business research and innovation should focus on the specific technological needs of the food industry that arise from actual industry performance against quantitatively derived benchmarks using a food protection systems approach.

End Notes

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About the Author

John Hnatio is the Chief Science Officer at FoodQuestTQ LLC. His career with the U.S. Government and industry spans a period of over 35 years where he has been involved in risk management. His service to the nation includes threat analysis, vulnerability assessments and the implementation of safety and security risk countermeasures at

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