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Defending the Food Supply Chain: Retail Food, Foodservice and their Wholesale Suppliers

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Defending the Food Supply Chain: Retail Food, Foodservice and their Wholesale Suppliers Authors

Research Report to the National Center for Food Protection and Defense
University of Minnesota

Abstract:

This report details the activities and findings of a three year research project funded by The National Center for Food Protection and Defense at the University of Minnesota, a Homeland Security Center of Excellence. The project was conducted by three universities each taking responsibility for collecting data on a different part of the food supply chain. The overall goal was to ascertain the food defense practices and readiness of food firms along the food supply chain to defend their food and other assets from a potential terrorist attack. David Closs in the Supply Chain Management Center at Michigan State University was the named leader of the overall project. Dr. Closs and his colleagues investigated the practices of food manufacturers and some wholesalers. Chip White and Alan Erera from the Georgia Institute of Technology investigated the practices of trucking companies and Jean Kinsey and colleagues at The Food Industry Center at the University of Minnesota investigated the food defense practices of retailers (grocers and foodservice) and wholesalers who supply both these channels. This report focuses on the work of The Food Industry Center and the benchmarks of the retail and wholesale food companies.

This project addresses the need to increase awareness of food system vulnerabilities among retail and wholesale food companies and enhance their preparedness for catastrophic incidents. Initial interviews and pilot surveys established the management and operations practices at retail, wholesale, and food service companies that lead to tightened security at a variety of food companies. The lessons learned from the initial stage of the project were incorporated into a comprehensive survey to ascertain the best practices in management, employment, communication, and information preparedness among firms in the wholesale/retail end of the food supply chain. The project will produce a benchmark report against which food companies can judge their relative level of preparedness for prevention, detection, response, and recovery. Results will be used to develop a set of best practices, a benchmarking (diagnostic) software tool for food companies to use and recommendations on improving food security practices, protecting employees and consumers, reducing vulnerabilities, and enhancing consumer confidence in the safety of the food supply.

Key Words:

Food Defense, Terrorism, Benchmark Practices, Diagnostic Tool

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Defending the Food Supply Chain: Retail Food, Foodservice and their Wholesale Suppliers

EXECUTIVE SUMMARY

This project addresses the need to increase awareness of food system vulnerabilities among retail and wholesale food companies and enhance their preparedness for resilience and recovery from deliberate attacks on their food and other assets. It is part of larger supply chain project; other segments of the project have benchmarked the preparedness of food manufacturers and transportation companies. This report focuses on benchmarking the preparedness of retailers (grocers and foodservice) and their wholesalers. The work was conducted at The Food Industry Center located at the University of Minnesota.

Benchmarking the practices of food firms was accomplished through interviews and surveys of corporate headquarters and a mailed survey, with an Internet option, was sent to 966 companies in two waves of mailings. There was an eight percent response rate that represented approximately fifty-seven percent of food sales in these companies' sectors**.** The responsibility (job description) of recipient/respondents was in the areas of Quality Assurance (25%), Security (22%), Operations (23%), Risk Management (16%), and Other (12%).

Operational Defense Competencies clustered the 109 questions into four primary groups of firm activities 1) Practices, 2) People , 3) Supply Chain Partners, and 4) Food Products. Within each of these four groups, responses to questions were subdivided into eight sub-competency activities:

- Practices: Physical Security; Strategy/Security Protocols; Audits/Metrics
- People: Communications; Training
- Supply Chain Partners: Supply Chain Collaboration; Supply Chain Verification
- and Food Products: Tracking/Monitoring.

Overall findings:

- Foodservice companies score the best on five of the eight sub competencies

    - Strategy/Security Protocols
    - Audits/Metrics
    - Communications
    - Training
    - Supply Chain Verification

Foodservice wholesalers scored the best on

- Supply Chain Collaboration
- Tracking/Monitoring

Grocery Wholesalers scored best on

- Physical Security

These findings formed the basis for an on-line diagnostic tool for use by food companies to benchmark themselves against their industry peers.

Sorting companies by demographic characteristics shows the better performers to be:

- Larger companies on all competencies
- Cooperatives had higher scores on physical security than for-profit companies
- The larger the market area (global or national vs. regional and local) and the larger the supply chain scope within a market correlates with higher scores in communications, audits and metrics, collaboration and tracking/monitoring.

Companies were asked about the benefits they perceived from having engaged in food defense practices. Results showed that:

Foodservice retailers perceived

- Better detection of incidents within their company and across their supply chains
- Increased supply chain resilience
- Reduced shrink (loss of product)
- Reduced personnel injuries
- Reduced insurance costs

Wholesalers as a group perceived

- Decrease in incidents in their firms

Manufacturers perceived
- Improved risk profile
- Increased firm resilience
- Reduced supply chain operating costs

Food Retailers perceived
- Decreased incidents across the supply chain
- Improved supply chain risk profile
- Reduced personal injuries
- Reduced employee turnover

Conclusions and Observations:

- Firms are better prepared for food defense against terrorism within their own firms than they are in collaboration with their suppliers.
- There is much room for improvement in coordination between firms along the food supply chain.
- Foodservice companies have invested more in food defense practices probably because they have a stronger brand to protect. Their company is their brand unlike retail food companies who sell a variety of brands and manufacturers who often sell many types of products. Also, foodservice retailers are large and global and more vulnerable to attack as an American icon.
- The Food Defense Diagnostic Tool is a major output from this project; it is being tested and refined during 2008. It is available to food firms at: http://foodindustrycenter.umn.edu/Food_Defense_Diagnostic_Tool.html

INTRODUCTION

The tragic events of September 11, 2001 mark the beginning of a cruel realization that protecting our nation is a much harder and more widespread dilemma facing not only the government, but every citizen in the country. Despite the fact that the number of terrorist attacks has been rising over the past 35 years, none of the previous attacks were of the magnitude or caused the devastation of the September 11, 2001 attack on the World Trade Center in Lower Manhattan, New York (Mohtadi, H and Murshid, P, 2006). However, the likelihood of a much smaller, though by no means less significant attack, is more possible now than ever before. According to Mohtadi and Murshid, "assuming a continuation of recent trends in the use chemical, biological or radio-nuclear agents, an attack of the same magnitude as that on the Tokyo subway in 1995 is expected to occur by 2009" (Mohtadi, H and Murshid, P, 2006). Thus, a deeper look into the preparedness for responding to a possible attack is vital for every organization.

The food industry, unfortunately, is among the top seventeen possible targets, identified by the U.S. government, where the smallest amount of chemical, biological or radio-nuclear agent could have a widespread, deadly, and economically crippling effect (Takhistov and Bryant, 2006). Even Tommy Thompson, the Secretary of Health and Human Services (2001 -2005) acknowledges the vulnerability of the nation's food supply and the urgency of developing procedures, processes, and techniques that would allow us to ensure the safety of the food.

Passage of the Bio-Terrorism Act of 2002 enabled the government to improve its ability to prevent, detect, and respond to a possible terrorist attack; however, there are still many weaknesses along the farm-to-fork continuum which remains highly vulnerable to an attack. An attack would result in:

- disruption of raw materials/ingredient flow;
- disruption of processing facilities;
- systemic failure due to delayed recognition of the select agent;
- disruption in the product demand flow;
- loss of consumer confidence in food safety (Takhistov and Bryant, 2006).

To prevent or at least diminish the likelihood of such an event, an investigation into the security of the food supply chain is critical. This document reviews the research results from the Benchmarking Survey funded by the National Center of Food Protection and Defense (NCFPD), a Department of Homeland Security Center of Excellence. The following report provides the final results to NCFPD, Department of Homeland Security, food firms and organizations that participated in the research, and the public.

RESEARCH OVERVIEW AND OBJECTIVES

This research focuses on food supply chain security and defense. For the purposes of this research, supply chain protection and security, is defined as: "The application of policies, procedures, and technology to protect food supply chain assets (product, facilities, equipment, information, and personnel) from theft, damage, or terrorism and to prevent the introduction of unauthorized contraband, people, or weapons of mass destruction" (Closs et al, 2006, 2007; The Global Logistics Research Team, 1995). Based on this definition, the objectives of food supply chain defense are:

1. preventing any biological, chemical, or unauthorized agent to be incorporated into the product;
2. preventing any illegal commodity to be intermingled with the shipment;
3. preventing transportation assets or a shipment's contents from being used as a weapon;
4. preventing unauthorized access to the product and/or food supply chain network; and
5. preventing disruptions of the food supply chain network/infrastructure.

Considering these food defense objectives, the specific objectives of this report are to:

1. provide firms with in-depth understanding of the competencies of food supply chain defense;
2. define food supply chain defense competencies and their use across the food supply chain;
3. identify and compare the food supply chain defense efforts across firms of different sizes;
4. identify best practices by firms within and across sectors of the food supply chain;
5. identify the performance results for firms who employ defense initiatives;
6. define the food supply chain defense competencies that differentiate high and low performing firms from a food defense perspective;
7. and present a diagnostic tool that will become available for food firms to benchmark their food defense practices against their peer companies.

Demands for food defense have increased significantly over the past five years. Since the catastrophic events of September 11, 2001, the food industry, among others, has been forced to realize the main security threats are no longer unintentional incidents. The presence of heightened terrorism and the danger of intentional incidents became more vivid and more likely to seriously threaten every organization in the country. Thus, efforts to minimize potential incidents can no longer primarily rely on food safety or quality control, personnel focused on production, storage, or retail facilities measures. While such a perspective may have been acceptable when the incidents were unintentional and the impact limited, it is now necessary to expand the focus. The implication is that defense initiatives require a cross-functional, trans-disciplinary and global supply chain perspective.

SURVEY METHODOLOGY

Using this cross-disciplinary perspective, this research investigates the defense practices of firms in the food industry. The primary research focus of this report is the investigation of retail food and foodservice providers and their wholesale suppliers. The first task was to develop some understanding regarding the issues and challenges related to food defense within these groups. An understanding was developed through the interviews with 12 food firms representing

retail food and foodservice retailers as well as their wholesale partners. The interviews included in-depth discussions with vice-presidents, directors, and managers responsible for their firm's food security (quality and safety). Seven of these firms completed an initial short written survey, which asked the interviewees about their views on the importance and validity of the proposed survey questions with regard to food defense. The interviews and pilot survey informed the development of a larger survey. This phase of the research established initial benchmarks and expectations about food firm practices and intentions related to food defense.

In order to coordinate survey questions and make them comparable across sectors of the food supply chain, researchers from the University of Minnesota and Michigan State University met in person and in several conference calls to discuss the format and ordering of the survey questions. Survey questions were also coordinated with Alan Erera from the Georgia Institute of Technology, who was overseeing the transportation portion of the survey, to ensure the same questions would be asked of food firms in all parts of the supply chain. The design of the comprehensive survey was a joint effort across these schools and research teams.

Next, the project identified and compared industry practices and determined the "average" level of preparedness in the food industry and the firms that were doing the "best." To conduct the analysis (and subsequently develop the diagnostic tool) a 109-question survey inquiring about security and defense practices and their perceived affects on the food companies was mailed to over 800 companies representing the four primary sectors of the food supply chain: 1) Retail Grocery; 2) Retail Foodservice; 3) Wholesale Grocery; and 4) Wholesale Foodservice. These firms ranged in size from international conglomerates to small family owned stores. To encourage higher participation, the survey was designed to be anonymous, thus allowing each participant to answer specific food defense questions without fear of exposing

sensitive company information and/or practices. Moreover, to ensure the survey encompassed the most critical food defense measures and mitigating factors, a sample survey that incorporated industry views obtained from the in-depth interviews performed earlier, was presented in person to several industry executives at meetings of The Food Industry Center's Program Leadership Board. The Board was asked to evaluate the validity, completeness and clarity of the questions and after incorporating the reviewers' suggestions the survey was completed and sent out.

In an effort to collect as many survey responses as possible, the surveys were sent out in two separate phases. Phase one sent the survey to 400 top foodservice and retail food companies ranked according to their 2005 – 2006 annual sales by Chain Store Guide (CSG) and the Nation's Restaurant News (http://www.csgis.com/csgis-frontend/). Surveys were mailed to the company personnel in Quality Control or Security whenever they could be identified; otherwise surveys were directed to owners, CEO's, or managers. The survey recipients were given the option to respond using a password protected web-based survey site or fill out a hard copy of the survey and mail it in. The Dillman method of survey design was followed with follow-up reminders and a second survey instrument sent to those who had not responded after two months in each of the mailing phases (Dillman, 2000). Given the similarity of the three survey instruments and the similarity in the programming needed to set up the Internet data collection, all survey data was collected via Michigan State University's website. Each of the schools had access to the other's data.

The second phase of the data collection from retailers and wholesalers was preceded by phone screenings to help ensure that the booklets were indeed addressed to the correct company representatives responsible for food defense. Two weeks after the additional 400 survey booklets were mailed out, the newly selected foodservice and retail food companies (once again

selected according to their annual revenue), were called to ensure the surveys were received and to remind the recipients that there is a two-week deadline to complete the survey. To ensure that all the responses would be incorporated into the final dataset, the survey submission deadline was extended for two weeks (the survey booklet {questionnaire} is in Appendix I).

Table 1 summarizes the sample size and final response rate for each sub-sample across both mailing phases.

TABLE 1

Sample Frame and Response Rates

POPULATION	SAMPLE SIZE	RESPONSE RATE
Grocery Retail	297	4.70%
Grocery Wholesale	185	9.19%
Foodservice Retail	287	2.79%
Foodservice Wholesale	197	6.09%

The low response rate illustrates the difficulty of gathering data from private companies. However, the companies who did respond represent roughly 57 percent retail food sales (using industry statistics provided by Chain Store Guide) and thus their defense practices represent a large part of the retail and wholesale segment of the supply chain. In the case of the foodservice sector, the respondents represent roughly ten percent of the foodservice sales. One factor in the low response rate is several respondents selected a business type (i.e. manufacturer) that was different than the type of company we originally identified. The situation illustrates the diversity and complexity of firms in the food supply chain. For example, some retail grocery chains are also “wholesalers/distributors” and some also have manufacturing facilities.

As illustrated in Table 2, the survey respondents reflected a broad range of management responsibilities involved with food defense. This task is not confined to a commonly identified

department or position as of yet, although more than 20 percent of the companies had an officer designated to be in charge of "security."

TABLE 2
Survey Respondent Responsibilities

RESPONSIBILITY	NUMBER OF RESPONDENTS	PERCENT OF TOTAL
Operations	14	20.6
Quality Assurance	22	32.4
Risk Management	9	13.2
Security	12	17.6
Other	11	16.2
TOTAL	68	100

The survey asked the respondents to identify various demographic characteristics about their respective firms to allow the analysis to account for these differences and determine if they are statistically significant. Table 3 outlines the various characteristics of the participating firms in the form of descriptive statistics**.** Most of the companies are large (over $100 million in annual revenue), are regional in scope, and are for-profit companies; 22% are cooperatives.

TABLE 3
Survey Respondent Demographics

Demographic Characteristic	Frequency	Percent of Total
Foodservice Retail	8	11.76
Foodservice Wholesale	12	17.65
Food Retail	14	20.59
Food Wholesale	17	25.00
Manufacturer	17	25.00
Large (revenue greater then 100mil)	54	79.41
Small (revenue less then 100mil)	14	20.59
Global	17	25.00
Local	1	1.47
National	27	39.71
Regional	23	33.82
Cooperative	12	17.65
For Profit	51	75.00
Other Tax Status	5	7.35

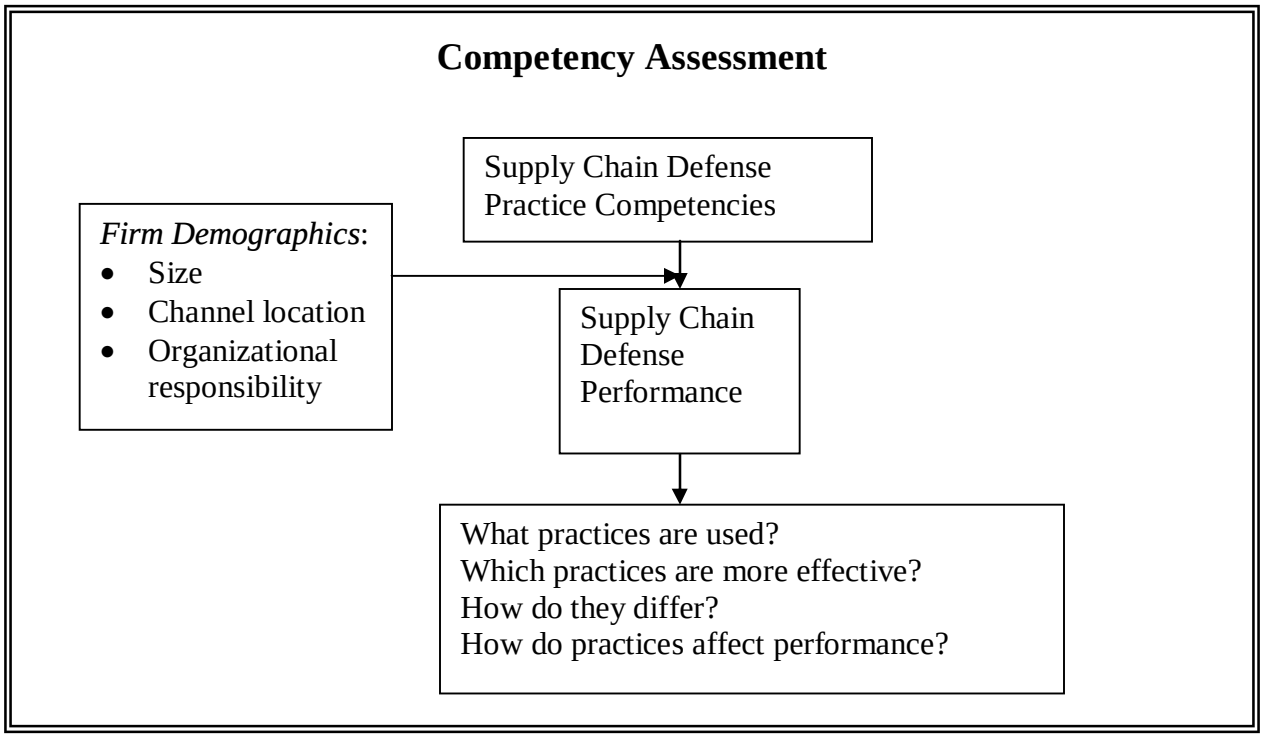
DIMENSIONS OF FOOD SECURITY AND DEFENSE

This research extends the thinking on terrorism prevention practices into the broader supply chain security framework involving multiple competencies (groups of practices), sources of risk, and supply chain partnerships. In an effort to cover the entire supply chain, this survey research is part of a joint research project by three Universities. The research dimension completed by the University of Minnesota team focuses on retail food stores, foodservice retailers, and grocery and foodservice wholesalers. Other supply chain stages investigated by partner institutions were the logistics service providers conducted by the Georgia Institute of Technology and the food manufacturers and wholesalers conducted by Michigan State University (MSU). All three university research teams employed a similar research framework with similar survey questions to allow comparison on defense practices across the supply chain.

This process makes it possible to identify specific practices and highlight core competencies that firms have or have not developed in order to defend their food products, company assets, supply chains, and customers. Based on the industry interviews, review of the literature and prior research by David Closs at MSU, the framework suggests that ten groups of practices or competencies determine a firm's supply chain defense performance. (See Figure 1; Closs et al., 2006.)

Figure 1 illustrates the overall research approach in this project.

FIGURE 1



Michigan State Model of Competencies

Within this framework, there were ten security competencies identified using the Michigan State Model. Competencies are clusters of questions that together, comprise a common set of activities. They are designated as 1) Process Strategy; 2) Process Management;

3) Infrastructure Management; 4) Communication Management; 5) Technology Management; 6) Process Technology; 7) Metrics; 8) Relationship Management; 9) Service Provider Collaboration Management; and 10) Public Interface Management. Figure 2 illustrates how these competencies work together to build a good food defense system for a food firm (see Appendix II for a more complete discussion of these competencies). Table 4 provides the definition for each competency. In the present context, security competencies are defined as the synthesis of selected security practices into a logically coherent and consistent category that describes a management focus to defend the food supply chain. Competencies have often been used to describe best-practice frameworks in business and specifically supply chain research.

FIGURE 2

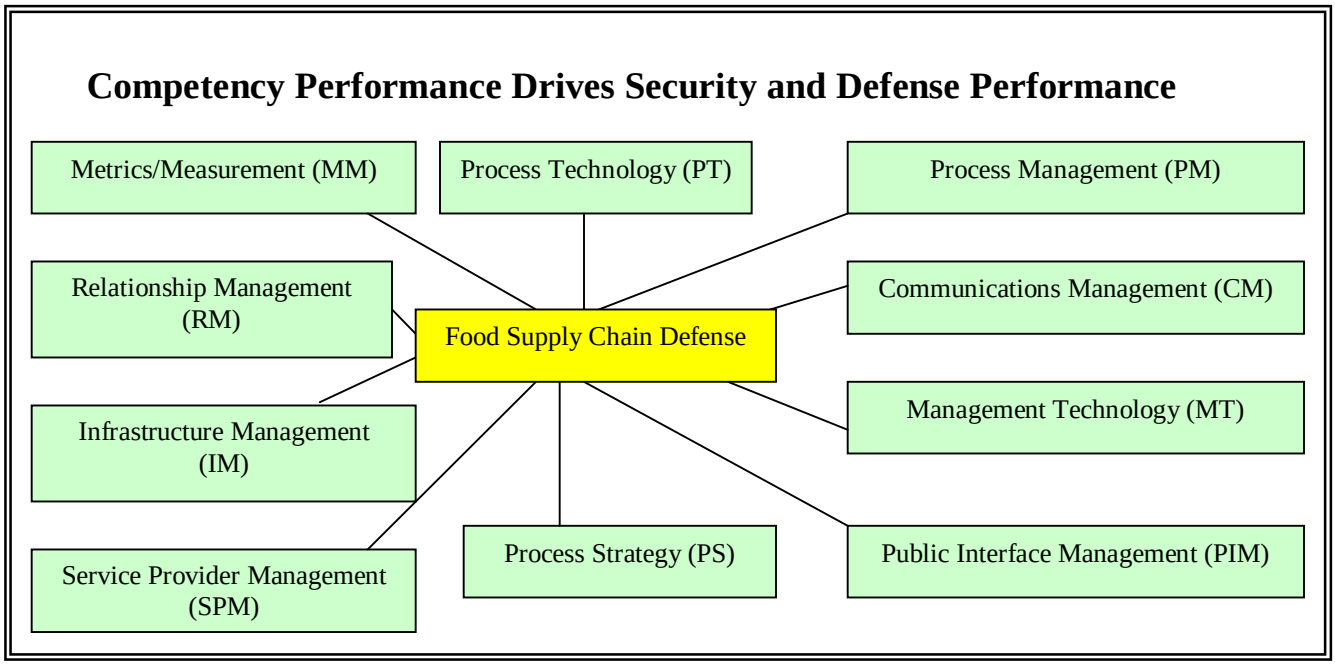


TABLE 4

Definitions of Competencies

Process Strategy (PS) – executive commitment to security and institution of a culture of security

Process Management (PM) – the degree to which specific security provisions have been integrated into processes managing the flow of products, services and information

Infrastructure Management (IM) – security provisions that have been implemented to security the physical infrastructure

Communications Management (CM) – internal information exchange between employees, managers, and contractors to increase security

Management Technology (MT) – the effectiveness of existing information systems for identifying and responding to a potential security breach

Process Technology (PT) – specific technologies implemented to limit access and trace the movement of goods

Metrics/Measurement (MM) – the availability and use of measurement to better identify and manage security threats

Relationship Management (RM) – information sharing and collaboration between supply partners

Public Interface Management (PIM) – the security related relationships and exchanges of information with the government and the public

Service Provider Management (SPM) – information sharing and collaboration between the firm and its logistical service providers

An important note about the framework is that each of these competencies applies to every member of the supply chain. Specifically, the framework implies that manufacturers, retailers, and logistics service providers are no different in their need for each of the competencies. Firms at different stages of the supply chain might apply these competencies somewhat differently or place much greater emphasis on some competencies over others.

However, each competency ideally occurs within each supply chain partner at both the "overall" (e.g., corporate) and local (e.g., warehouse, manufacturing site) level. In addition, relationship management, communication management, and shared metrics need to exist between supply chain partners to improve the overall level of defense.

Performance Indicators

Table 5 lists the specific performance metrics measured by this research. These data were collected in the third and last section of the survey; they are indicators of how well the company perceived they were doing "as a result of having implemented defense practices." The first three performance measures focus on the firm's perceived ability to detect security incidents, reduce the number of security incidents, and the ability to recover from security incidents. The next two performance measurement categories focus on financial elements including firm and supply chain cost, insurance risk profile, product shrink, injuries, and employee turnover. The final two measurement categories focus on performance relative to competitors and the firm and supply chain's capacity to meet required security standards.

TABLE 5

Performance Measures

Directory and Recovery:

- Ability to detect security incidents
- Reduction in the number of security incidents
- Increased resilience in recovery

Finance:

- Changed risk profile
- Changed firm and supply chain cost, shrink, injuries, and turnover

Capacity:

- Improved security relative to competitors
- Improved ability to meet security requirements

Operational Competencies

During the course of several conversations with the food industry leaders, the competencies as described above, though comprehensive, were not readily understood and did not readily translate into operational practices within a food company. Consequently, we rearranged and re-labeled a set of competencies (based on the same set of questions/surveys) around four operational activities of the firm: operational practices, people, partners and products. This scheme met with greater recognition in the field and served as the basis for our final analysis. The main purpose of these competencies was to identify sets of practices that were relevant primarily to retail and wholesale food sectors of the food industry. In developing these competencies, the collected survey data was clustered into four major food defense areas which, according to the food terrorism literature and the conversations with food industry executives, were identified as playing significant and unique roles in food defense. To distinguish these competencies from the original list of competencies from the Michigan State University model they will henceforth be called Operational Defense Competencies.

To promote an even deeper understanding of the drivers of these unique roles, each food defense area was further divided into two or three sub-competencies, which then specifically outline the food defense practices evaluated. Analyzing food defense practices using these Operational Defense Competencies promoted recognition by executives in the food industry. They stated that operational defense competencies were helpful in promoting transparency and industry understanding of the particular practices that constitute each major food defense area. Evaluating the four identified food defense areas and fitting the survey questions within each of them, the following eight sub-competencies emerged:

1) **Physical Security** (OPERATIONAL PRACTICES),
2) **Audits and Metrics** (OPERATIONAL PRACTICES),

3) **Strategy/Security Protocols** (OPERATIONAL PRACTICES),
4) **Communication** (PEOPLE),
5) **Training** (PEOPLE),
6) **Supply Chain Collaboration** (PARTNERS),
7) **Supply Chain Verification** (PARTNERS),
8) **Tracking/Monitoring** (PRODUCTS).

Figure 3 illustrates how these supply chain defense competencies fit together to create a better understanding of food defense and its influential measures.

FIGURE 3

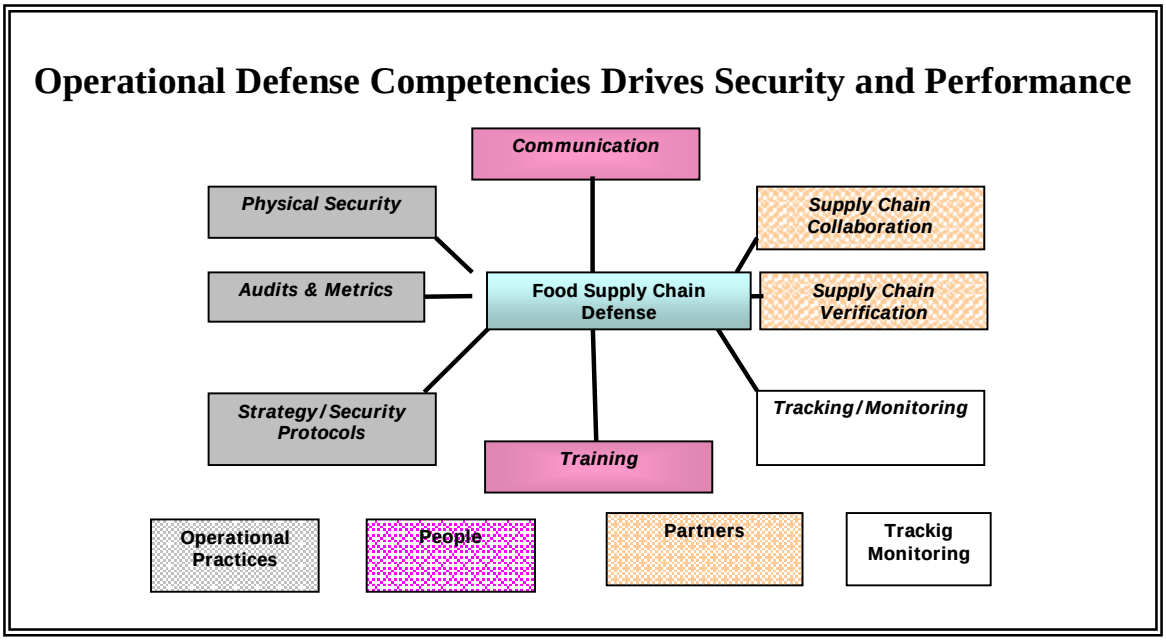


Table 6 provides definitions for each of the four food defense areas and their competencies.

TABLE 6

Definitions of Operational Defense Competencies

- **Practices – evaluates the company's food security and defense practices by analyzing its focus on:**

  1. ***Physical Security*** - the presence of access controls, cameras, security protocols during the stages of processing, transportation, and storage
  2. ***Audits & Metrics*** - the use of audit/certification of both internal and external security programs and the use of universal supply chain security metric systems
  3. ***Strategy/Security Protocols*** - the presence of security protocols, continuity plans, and enterprise-wide strategy to address security concerns

- **People – evaluates the company's relationship with its employees by analyzing the following practices:**

  1. ***Communication*** – the presence of communication protocols and strategies for providing information about security/contamination incidents to its employees, supply chain partners, and governmental agencies
  2. ***Training*** – the use of education programs and emergency-preparedness simulations to train the employees to recognize and respond to security breaches and contamination hazards

- **Supply Chain Partners – evaluates the cooperation between the company and its supply chain partners by analyzing its focus on:**

  1. ***Supply Chain Collaboration*** – the presence of information sharing and emergency preparedness programs/protocols between the company and its supply chain partners
  2. ***Supply Chain Verification*** – the use of intra-partner audits and security assessment practices in improving joint security and food defense practices

- **Food Products – evaluates the company's ability to respond to contaminations or food defense emergencies by analyzing its practices in:**

  1. ***Tracking/Monitoring*** – the use of GPS and RFID in tracking and monitoring the products along the "farm to fork" route, and the incorporation of Hazard Analysis and Critical Control Point system in mitigating and responding to contaminations and security breaches

BENCHMARKING OPERATIONAL COMPETENCIES

Methodology

After identifying the four major food defense areas and segregating them into eight operational competencies, factor analysis was applied to identify the smallest number of ***quality dimensions*** that underlie the above described eight competencies. Factor analysis is a commonly used method for data reduction and summarization. This method analyzes the relationship between the 109 food defense measures (questions) included in section one of the survey and identifies the unobserved latent variables that account for the correlation among them. To obtain these latent variables, principal components analysis, a form of factor analysis, was used. The principal component analysis was used because the method considers the total data variance, whereas a common factor analysis only analyses the common variability of the observed variables. As a result of this difference, principal component analysis accounts for the maximum portion of the variance in the original set of variables with a minimum number of components. Common factor analysis only extracts "a small number of factors which account for the inter-correlations among the observed variables" (University of Texas at Austin, 1995). In addition, the benefits of using factor analysis, as compared to obtaining the mean of the questions that comprise each competency, lie in the fact that the obtained factors explain the most data variance possible, allow for identifying the amount of variance explained, and allow for the use of multiple factors without risking multi-collinearity.

To determine the most influential questions within each factor and thus within each competency, the following standard selection method has been used:

1. A question was considered to be significant if its factor loading[3] was greater than 0.7 in absolute value;
2. Comparing two factors of each competency, a question was considered to belong to factor 1 if its factor loading was larger than 0.7 and greater than that of factor 2 and vice versa;
3. Questions with factor loadings less than 0.7 were considered to be not influential; however, were retained as variables in a regression analysis to capture the 50-63 percent of total data variance.

As a result, the 109 food defense practices identified by the survey were condensed to a total of 42 questions. Utilizing only these questions will ensure the practicality of the diagnostic benchmarking tool while maintaining the maximum amount of explanatory power possible. The questions that are clustered into each of the eight operational competencies are found in Appendix III.

The operational defense competencies are the basis for the final product of this research – the Diagnostic Tool available on the Internet. The tool can be accessed at http://foodindustrycenter.umn.edu/Food_Defense_Diagnostic_Tool.html. It is designed for food companies of any size to benchmark their defense practices (competencies) against the average of other firms in their sector of the supply chain and against the best performing company in that sector (who has participated in the survey or the diagnostic tool). Multi-unit companies can also utilize this tool to benchmark sub-groups of operating units against each other with a roll-up of scores to the overall company.

[3] "**Factor loadings** are the correlation coefficients between the firms scores (rows) and factors (columns)" Garson (2007).

RESULTS BASED ON COMPETENCIES FROM THE MICHIGAN STATE MODEL

The final analysis of the survey data focuses on three broad questions: 1) Where are retail food, foodservice and their wholesale suppliers focusing their defense efforts? Is there a difference between the supply chain channel members in competency focus and perceived security performance? 2) Do food supply chain defense initiatives make a difference to perceived performance? 3) What competencies make the most difference? Do better practices result in a better perceived performance?

The survey from The Food Industry Center at the University of Minnesota was sent to only retail food (grocery) and foodservice retail companies and their wholesale suppliers. However, several survey participants identified themselves as manufacturers. The reason is that several food retailers in addition to their retail activities also produce their own generic or private label brand products. Some form of manufacturing activity is not uncommon for retail companies. Therefore, the analysis of the initial four types of firms was expended to include the firms that identified themselves as manufacturers. The primary questions asked are:
Where are retail food, foodservice and their wholesale suppliers focusing their defense efforts?
Is there a difference between the supply chain partners in competency focus and security performance?

The final analysis determines where retail food and foodservice retailers and their wholesale suppliers are focusing their food defense efforts. Tables 7a – 7e present the competency scores for the five types of firms (retail food, foodservice retailers, grocery wholesalers, foodservice wholesalers and manufacturers) using the Michigan State Model (MSU). The World Class Benchmark represents the score of the best firm in that competency.

The questions were answered using a Likert-scaled questions (1 = Strongly Disagree and 5 = Strongly Agree). As the Likert-scale allowed for the selection of N/A, during the analysis of the survey these answers would represent "missing variables." To accommodate the statistical analysis, these missing variables were assigned the mean value of the responses to any given question by firms of the same type. As a reminder, a score of 1 indicates that a firm is not performing the activity queried by the question while a score of 5 indicates that the respondent strongly believes that the firm is performing the activity. A value of 3 indicates neutrality toward the statement.

TABLE 7a – MSU COMPETENCIES

Benchmark for Food Retail			
Food Supply Chain Security *Scale: Disagree 1 2 3 4 5 Agree*	**Firm Mean**	**World Class Benchmark**	**Gap**
Process Management	3.30	4.59	1.29**
Process Strategy	3.27	4.32	1.05**
Infrastructure Management	3.45	4.68	1.23**
Communication Management	3.34	5.00	1.66**
Management Technology	3.75	4.86	1.11**
Process Technology	2.61	4.40	1.79**
Public Interface Management	3.46	4.64	1.18**
Metrics/Measurement	2.93	4.63	1.70**
Service Provider Management	2.70	4.24	1.54**
Relationship Management	2.13	3.45	1.32**
Overall Score	**3.09**	**4.48**	**1.39**

** indicates statistical significance on a less than 1 percent level (The gap is significant)
* indicates statistical significance on a less than 5 percent level

By analyzing Table 7a using the mean of the firms' means to indicate the average industry responsiveness, the results indicate that the retail food sector primarily focuses on

Process Management, Process Strategy, Infrastructure Management, Communication Management, Management Technology and Public Interface Management. Process Technology, Metrics/Measurement, Service Provider Management and Relationship Management receive some focus, but not enough to indicate even a mildly strong focus. Thus, it can be concluded that the retail food sector focuses its defense efforts on:

- Securing the flow of products, service and information;
- Securing the physical infrastructure;
- Increasing the effectiveness of existing information systems for identifying and responding to a potential security breach;
- Improving internal information exchange between the employees and managers;
- Maintaining a culture of security and executive commitment to security;
- Maintaining relationships and promoting exchange of information with the government and the public.

The following table represented the MSU competency results for the foodservice retail sector.

TABLE 7b – MSU COMPETENCIES

Benchmark Results for Foodservice Retail			
Food Supply Chain Security *Scale: Disagree 1 2 3 4 5 Agree*	**Firm Mean**	**World Class Benchmark**	**Gap**
Process Management	4.07	5.00	0.93**
Process Strategy	3.89	4.53	0.64**
Infrastructure Management	3.76	4.78	1.02**
Communication Management	3.91	5.00	1.09**
Management Technology	4.16	4.93	0.77**
Process Technology	3.12	4.45	1.33**
Public Interface Management	3.88	4.91	1.03**
Metrics/Measurement	4.03	4.75	0.72**
Service Provider Management	3.74	4.63	0.89**
Relationship Management	3.49	4.50	1.01**
Overall Score	**3.81**	**4.75**	**0.94**

** indicates statistical significance on a less than 1 percent level (The gap is significant)
* indicates statistical significance on a less than 5 percent level

Analyzing the results from Table 7b for foodservice retailers indicates a primary focus on Process Management, Process Strategy, Communication Management, Management Technology, Public Interface Management, and Metrics/Measurement. Infrastructure Management, Process Technology, Service Provider Management and Relationship Management receive some focus, but not enough to indicate even a mildly strong focus. Thus, it can be concluded that the foodservice retail sector focuses its defense efforts on:

- Securing the flow of products, service and information;
- Increasing the effectiveness of existing information systems for identifying and responding to a potential security breach;
- Improving the availability and use of measurement to better identify and manage security threats;
- Improving internal information exchange between the employees and managers;
- Maintaining a culture of security and executive commitment to security;
- Maintaining relationships and promoting exchange of information with the government and the public.

The following table represents the MSU competency results of the retail food wholesalers sector.

TABLE 7c – MSU COMPETENCIES

Benchmark Results for Food Wholesale			
Food Supply Chain Security *Scale: Disagree 1 2 3 4 5 Agree*	**Firm Mean**	**World Class Benchmark**	**Gap**
Process Management	3.45	4.56	1.11**
Process Strategy	2.89	4.06	1.17**
Infrastructure Management	3.55	4.30	0.75**
Communication Management	3.18	3.57	0.39**
Management Technology	3.94	4.51	0.57**
Process Technology	2.78	3.80	1.02**
Public Interface Management	3.37	4.91	1.54**
Metrics/Measurement	2.78	3.63	0.85**
Service Provider Management	2.76	3.60	0.84**
Relationship Management	2.14	3.00	0.86**
Overall Score	**3.08**	**3.99**	**0.91**

** indicates statistical significance on a less than 1 percent level (The gap is significant)
* indicates statistical significance on a less than 5 percent level

Analyzing the results from Table 7c for retail food company wholesalers, indicates that this sector primarily focuses on Process Management, Infrastructure Management, Communication Management, Management Technology and Public Interface Management. Process Strategy, Process Technology, Metrics/Measurement, Service Provider Management and Relationship Management receive some focus, but not enough to indicate even a mildly strong focus. Thus, it can be concluded that the food wholesale sector focuses its defense efforts on:

- Securing the flow of products, service and information;
- Securing the physical infrastructure;
- Increasing the effectiveness of existing information systems for identifying and responding to a potential security breach;
- Improving internal information exchange between the employees and managers;
- Maintaining relationships and promoting exchange of information with the government and the public.

The following table contains the MSU competency results for the foodservice wholesale sector.

TABLE 7d – MSU COMPETENCIES

Benchmark Results for Foodservice Wholesale			
Food Supply Chain Security *Scale: Disagree 1 2 3 4 5 Agree*	**Firm Mean**	**World Class Benchmark**	**Gap**
Process Management	4.05	4.89	0.84**
Process Strategy	3.43	4.75	1.32**
Infrastructure Management	3.58	4.89	1.31**
Communication Management	3.87	5.00	1.13**
Management Technology	4.41	4.87	0.46**
Process Technology	2.84	3.93	1.09**
Public Interface Management	3.86	4.91	1.05**
Metrics/Measurement	3.48	4.63	1.15**
Service Provider Management	3.01	4.20	1.19**
Relationship Management	2.59	4.70	2.11**
Overall Score	**3.51**	**4.68**	**1.17**

** indicates statistical significance on a less than 1 percent level (The gap is significant)
* indicates statistical significance on a less than 5 percent level

Analyzing the results from Table 7d for the foodservice wholesaler sector, indicates that the primary focus of the sector rests on Process Management, Infrastructure Management, Communication Management, Management Technology, and Public Interface Management. Process Strategy, Process Technology, Service Provider Management and Relationship Management receive some focus, but not enough to indicate even a mildly strong attention. Thus, it can be concluded that the foodservice wholesale sector focuses its defense efforts on:

- Securing the flow of products, service and information;
- Increasing the effectiveness of existing information systems for identifying and responding to a potential security breach;
- Increasing the effectiveness of existing information systems for identifying and responding to a potential security breach
- Improving internal information exchange between the employees and managers;
- Maintaining relationships and promoting exchange of information with governments and the public.

The following table represents the MSU competency results for the self-identified manufacturers.

TABLE 7e – MSU COMPETENCIES

Benchmark Results for Manufacturers			
Food Supply Chain Security *Scale: Disagree 1 2 3 4 5 Agree*	**Firm Mean**	**World Class Benchmark**	**Gap**
Process Management	3.54	4.70	1.16**
Process Strategy	3.18	4.25	1.07**
Infrastructure Management	3.37	4.72	1.35**
Communication Management	3.77	5.00	1.23**
Management Technology	4.03	4.87	0.84**
Process Technology	2.78	3.60	0.82**
Public Interface Management	3.50	4.91	1.41**
Metrics/Measurement	3.46	4.38	0.92**
Service Provider Management	3.03	4.20	1.17**
Relationship Management	2.16	3.10	0.94**
Overall Score	**3.28**	**4.37**	**1.09**

** indicates statistical significance on a less than 1 percent level (The gap is significant)
* indicates statistical significance on a less than 5 percent level

Analyzing the results from Table 7e for the manufacturers, indicates that the primary focus rests on Process Management, Infrastructure Management, Communication Management, Management Technology, Public Interface Management and Metrics/Measurement. Process Strategy, Process Technology, Service Provider Management and Relationship Management receive some consideration, but not enough to indicate even a mildly strong focus. Thus, it can be concluded that the manufacturing sector focuses its defense efforts on:

- Securing the flow of products, service and information;
- Securing the physical infrastructure;
- Increasing the effectiveness of existing information systems for identifying and responding to a potential security breach;
- Improving internal information exchange between the employees and managers;
- Maintaining relationships and promoting exchange of information with the government and the public;
- Improving the availability and use of measurement to better identify and manage security threats.

Conclusions from MSU Competencies

According to these results, it can be concluded from the MSU competencies that foodservice retailers and their wholesale partners are placing a greater emphasis on defense efforts then grocery retailers and their wholesale partners. Comparing retail food (grocery) and foodservice retail, one will notice that foodservice retailers are performing between 7.4% and 30% better then the food retailers. The smallest difference can be observed in their attitude towards Infrastructure Management competency (7.4%), while the largest difference between the two sectors is their focus on the Relationship Management (30.0%). In the case of retail food and foodservice wholesalers, the best performers are foodservice wholesalers as they perform between 5% and 16.6% better on almost all competencies. However, in the case of Infrastructure Management and Process Technology, the retail food wholesalers are performing better by 3.6% and 3.8% respectively.

Tables 8a and 8b combine the results from the two types of retail channels and the two wholesale channels. By comparing the results of the two tables one can see that the overall scores are not dramatically different and that the retailers are somewhat ahead. Also, the format of these tables is very much like the format of the results obtained with the on-line Diagnostic Tool described above.

TABLE 8a

Benchmark Results for Retailers Combined			
Food Supply Chain Security *Scale: Disagree 1 2 3 4 5 Agree*	**Firm Mean**	**World Class Benchmark**	**Gap**
Process Management	3.64	5.00	1.36**
Process Strategy	3.69	4.73	1.05**
Infrastructure Management	3.61	4.83	1.23**
Communication Management	3.59	5.00	1.42**
Management Technology	3.89	4.93	1.04**
Process Technology	2.89	4.59	1.70**
Public Interface Management	3.65	4.77	1.13**
Metrics/Measurement	3.36	4.50	1.14**
Service Provider Management	3.21	4.82	1.62**
Relationship Management	2.85	4.25	1.40**
Overall Score	**3.44**	**4.74**	**1.31**

** indicates statistical significance on a less than 1 percent level (The gap is significant)

- indicates statistical significance on a less than 5 percent level

TABLE 8b

Benchmark Results for Wholesalers Combined			
Food Supply Chain Security *Scale: Disagree 1 2 3 4 5 Agree*	**Firm Mean**	**World Class Benchmark**	**Gap**
Process Management	3.68	4.45	0.77**
Process Strategy	3.15	4.68	1.53**
Infrastructure Management	3.53	4.50	0.97**
Communication Management	3.52	4.07	0.56**
Management Technology	4.16	4.63	0.48**
Process Technology	2.75	4.02	1.27**
Public Interface Management	3.65	4.68	1.04**
Metrics/Measurement	3.12	4.44	1.33**
Service Provider Management	2.90	4.25	1.36**
Relationship Management	2.29	3.37	1.08**
Overall Score	**3.27**	**4.31**	**1.04**

** indicates statistical significance on a less than 1 percent level (The gap is significant)
* indicates statistical significance on a less than 5 percent level

Comparing the retail and wholesale sectors using the mean of the firms' mean to indicate the average industry responsiveness, retailers indicate a stronger and more widespread defense focus compared to their wholesale partners. The overall competency score for the retail sector is 3.44, exhibiting a modestly stronger defense focus as determined by the proposed original competencies. The wholesale sector on the other hand, exhibits only a 3.27 overall competency score, indicating a weaker focus on defense. The main difference between the two sectors is that retailers place a much stronger focus on almost all competencies except Process Management and Management Technology where the wholesalers indicate a higher focus.

RESULTS USING OPERATIONAL DEFENSE COMPETENCIES

The following five tables (9a – 9e) represent the analysis of retail food (grocery), foodservice retail, retail food wholesalers, foodservice wholesalers and manufacturing sectors

through the use of the operational defense competencies. As a reminder, the operational defense competencies use almost the same survey questions as the original competencies. However, due to their unique composition (as their measures combine slightly different aspects of defense behavior) the overall competency scores are different compared to the MSU competency scores. Moreover, the surveys sent to retail food and foodservice retailers and their wholesale partners contained more questions then the surveys sent to manufacturers by Michigan State University and the logistics service providers by Georgia Institute of Technology. The operational defense competencies incorporate the additional University of Minnesota survey questions (109 compared to 87 in the MSU survey) whereas the MSU competency scores (Tables 7a-7e) were based only on the questions included in the MSU survey of manufacturers. The numbers in Tables 7, 8, and 9 reflect only the data collected by the University of Minnesota.

TABLE 9a – OPERATIONAL DEFENSE COMPETENCIES

Benchmark Supply Chain Defense - Food Retail			
Strongly Disagree 1 2 3 4 5 Strongly Agree	**Industry Average 2007**	**Industry Leader 2007**	**Gap b/w Leader & Firm**
Practices:			
Physical Security	3.48	5.00	1.52**
Strategy/Security Protocols	3.58	5.00	1.42**
Audits and Metrics	3.44	4.50	1.06**
People:			
Communications	3.36	5.00	1.64**
Training	3.14	4.00	0.86**
Supply Chain Partners:			
Supply Chain Collaboration	3.49	5.00	1.51**
Supply Chain Verification	1.97	3.50	1.53**
Food Products:			
Tracking/Monitoring	4.05	5.00	0.95**
Overall Score	**3.32**	**4.63**	**1.31**

** indicates statistical significance on a less than 1 percent level (The gap is significant)
* indicates statistical significance on a less than 5 percent level

By analyzing table 9a using the mean of the industry overall score as the point to indicate the average industry responsiveness, the results indicate that the retail food sector primarily focuses on Physical Security, Strategy/Security Protocols, Audits and Metrics, Communications, Supply Chain Collaboration and Tracking/Monitoring. Training and Supply Chain Verification receive some focus, but not enough to indicate even a mildly strong focus. Thus, it can be concluded that the retail food sector focuses its defense efforts on:

- securing the physical infrastructure;
- increasing the effectiveness of existing security protocols and information systems for identifying and responding to a potential security breach;
- improving internal information exchange between the employees, managers, and its supply chain partners;
- continuing the audit of its internal and external security programs and implementing the use of a unified metric system;
- and increasing the ability to track and monitor the flow of food products throughout the entire supply chain.

The following table represents the competency results for the foodservice retail sector.

TABLE 9b – OPERATIONAL DEFENSE COMPETENCIES

Benchmark Supply Chain Defense- Foodservice Retail			
Strongly Disagree 1 2 3 4 5 Strongly Agree	**Industry Average 2007**	**Industry Leader 2007**	**Gap b/w Leader & Firm**
Practices:			
Physical Security	3.90	5.00	1.10**
Strategy/Security Protocols	4.06	5.00	0.94**
Audits and Metrics	3.88	4.67	0.79**
People:			
Communications	3.97	5.00	1.03**
Training	3.69	4.75	1.06**
Supply Chain Partners:			
Supply Chain Collaboration	3.78	5.00	1.22*
Supply Chain Verification	3.42	4.57	1.15**
Food Products:			
Tracking/Monitoring	4.52	5.00	0.48*
Overall Score	**3.90**	**4.87**	**0.97**

** indicates statistical significance on a less than 1 percent level
* indicates statistical significance on a less than 5 percent level

The results from Table 9b indicate a primary focus on Physical Security, Strategy/Security Protocols, Communications, and Tracking/Monitoring. Audits and Metrics, Training, Supply Chain Collaboration and Verification receive some focus, but not enough to indicate even a mildly strong focus. Thus, it can be concluded that the foodservice retail sector focuses its defense efforts on:

- securing the physical infrastructure;
- increasing the effectiveness of existing security protocols and information systems for identifying and responding to a potential security breach;
- improving internal information exchange between the employees and managers;
- and increasing the ability to track and monitor the flow of food products throughout the entire supply chain.

The following table represents the competency results of the grocery wholesale sector.

TABLE 9c – OPERATIONAL DEFENSE COMPETENCIES

Benchmark Supply Chain Defense – Retail Food Wholesalers			
Strongly Disagree 1 2 3 4 5 Strongly Agree	Industry Average 2007	Industry Leader 2007	Gap b/w Leader & Firm
Practices:			
Physical Security	3.97	5.00	1.03**
Strategy/Security Protocols	3.52	5.00	1.48**
Audits and Metrics	3.02	3.90	0.88**
People:			
Communications	3.65	5.00	1.35**
Training	2.82	4.75	1.93**
Supply Chain Partners:			
Supply Chain Collaboration	3.48	4.68	1.20**
Supply Chain Verification	1.91	2.71	0.80**
Food Products:			
Tracking/Monitoring	4.39	5.00	0.61**
Overall Score	**3.35**	**4.51**	**1.16**

** indicates statistical significant on a less than 1 percent level

Results from Table 9c indicate that this sector primarily focuses on Physical Security, Strategy/Security Protocols, Communications, Supply Chain Collaboration and

Tracking/Monitoring. Audits and Metrics, Training, and Supply Chain Verification receive some focus, but not enough to indicate even a mildly strong focus. Thus, it can be concluded that the grocery wholesale sector focuses its defense efforts on:

- securing the physical infrastructure;
- increasing the effectiveness of existing security protocols and information systems for identifying and responding to a potential security breach;
- improving internal information exchange between the employees, managers, and its supply chain partners;
- increasing the effectiveness of existing collaborations between the firm and its supply chain partners;
- and increasing the ability to track and monitor the flow of food products throughout the entire supply chain.

The following table contains the competency results for the foodservice wholesale sector.

TABLE 9d –OPERATIONAL DEFENSE COMPETENCIES

Benchmark Supply Chain Defense - Foodservice Wholesalers			
Strongly Disagree 1 2 3 4 5 Strongly Agree	Industry Average 2007	Industry Leader 2007	Gap b/w Leader & Firm
Practices:			
Physical Security	3.55	4.75	1.20**
Strategy/Security Protocols	4.03	5.00	0.97**
Audits and Metrics	3.49	4.67	1.18**
People:			
Communications	3.92	5.00	1.08**
Training	3.10	4.75	1.65**
Supply Chain Partners:			
Supply Chain Collaboration	4.10	5.00	0.90**
Supply Chain Verification	2.39	4.86	2.47**
Food Products:			
Tracking/Monitoring	4.79	5.00	0.21*
Overall Score	**3.67**	**4.88**	**1.21**

** indicates statistical significant on a less than 1 percent level
* indicates statistical significant on a less than 5 percent level

Results from Table 9d indicate the primary focus of the sector rests on Strategy/Security Protocols, Communications, Supply Chain Collaboration and Tracking/Monitoring. Physical

Security, Audits and Metrics, Training and Supply Chain Verification receive some focus, but not enough to indicate even a mildly strong attention. Thus, it can be concluded that the foodservice wholesale sector focuses its defense efforts on:

- increasing the effectiveness of existing security protocols and information systems for identifying and responding to a potential security breach;
- improving internal information exchange between the employees, managers, and its supply chain partners;
- and increasing the ability to track and monitor the flow of food products throughout the entire supply chain.

The following table represents the competency results for the manufacturers.

TABLE 9e – OPERATIONAL DEFENSE COMPETENCIES

Benchmark Supply Chain Defense - Manufacturing			
Strongly Disagree 1 2 3 4 5 Strongly Agree	**Industry Average 2007**	**Industry Leader 2007**	**Gap b/w Leader & Firm**
Practices:			
Physical Security	3.66	5.00	1.34**
Strategy/Security Protocols	3.45	5.00	1.55**
Audits and Metrics	3.68	4.67	0.99**
People:			
Communications	4.29	5.00	0.71**
Training	2.77	4.00	1.23**
Supply Chain Partners:			
Supply Chain Collaboration	4.14	5.00	0.86**
Supply Chain Verification	1.90	4.00	2.10**
Food Product:			
Tracking/Monitoring	4.38	5.00	0.63*
Overall Score	**3.53**	**4.71**	**1.17**

** indicates statistical significant on a less than 1 percent level
* indicates statistical significant on a less than 5 percent level

Results from Table 9e, representing the self-identified manufacturers, indicate the primary focus rests on Physical Security, Audits and Metrics, Communications, Supply Chain Collaboration, and Tracking/Monitoring. Strategy/Security Protocols, Training, and Supply Chain Verification

receive some consideration, but not enough to indicate even a mildly strong focus. Thus, it can be concluded that the manufacturing sector focuses its defense efforts on:

- securing the physical infrastructure;
- increasing the effectiveness of existing security protocols and information systems for identifying and responding to a potential security breach;
- improving internal information exchange between the employees, managers, and its supply chain partners;
- increasing the effectiveness of existing collaborations between the firm and its supply chain partners;
- and increasing the ability to track and monitor the flow of food products throughout the entire supply chain.

Conclusions from the Operational Defense Competencies

Comparing the foodservice and retail food sectors based on these competencies and their mean scores, we find that the foodservice industry outperforms the retail food industry. Moreover, the foodservice retail sector ranks number one followed by foodservice wholesalers, retail food wholesalers and retail food. Furthermore, it was determined that the foodservice retail sector surpasses all the other three sectors in almost all the competencies except Physical Security where the retail food wholesalers rank higher, and Supply Chain Collaboration and Tracking/Monitoring where the foodservice wholesalers received higher mean scores.

The following table presents the cross sectional differences between the four original sectors.

TABLE 10 – OPERATIONAL DEFENSE COMPETENCIES

Cross Sectional Comparison on Food Supply Chain Operational Defense Competencies				
Scale: Disagree 1 2 3 4 5 Agree				
Supply Chain Members	**Foodservice Retail**	**Foodservice Wholesale**	**Grocery Retail**	**Grocery Wholesale**
	Firm Mean	**Firm Mean**	**Firm Mean**	**Firm Mean**
Practices:				
Physical Security	3.90	3.55	3.48	3.97
Strategy/Security Protocols	4.06	4.03	3.58	3.52
Audits and Metrics	3.88	3.49	3.44	3.02
People:				
Communications	3.97	3.92	3.36	3.65
Training	3.69	3.10	3.14	2.82
Supply Chain Partners:				
Supply Chain Collaboration	3.78	4.10	3.49	3.48
Supply Chain Verification	3.42	2.39	1.97	1.91
Food Products:				
Tracking/Monitoring	4.52	4.79	4.05	4.39
Overall Score	**3.90**	**3.67**	**3.32**	**3.35**

Comparing grocery and foodservice retail, foodservice retailers (column 2) are performing between 7.7% – 42.4% better then the grocery retailers (column 4). The smallest difference can be observed in their attitude towards Supply Chain Collaboration (7.7%), while the largest difference between the two sectors is their focus on the Supply Chain Verification (42.4%). In the case of grocery and foodservice wholesalers (columns 3 and 5), the best performers are foodservice wholesalers as they perform between 6.9% (Communications) and 15.1% (Supply Chain Collaboration) better on almost all competencies, except Physical Security where the grocery wholesalers outperform the foodservice wholesalers.

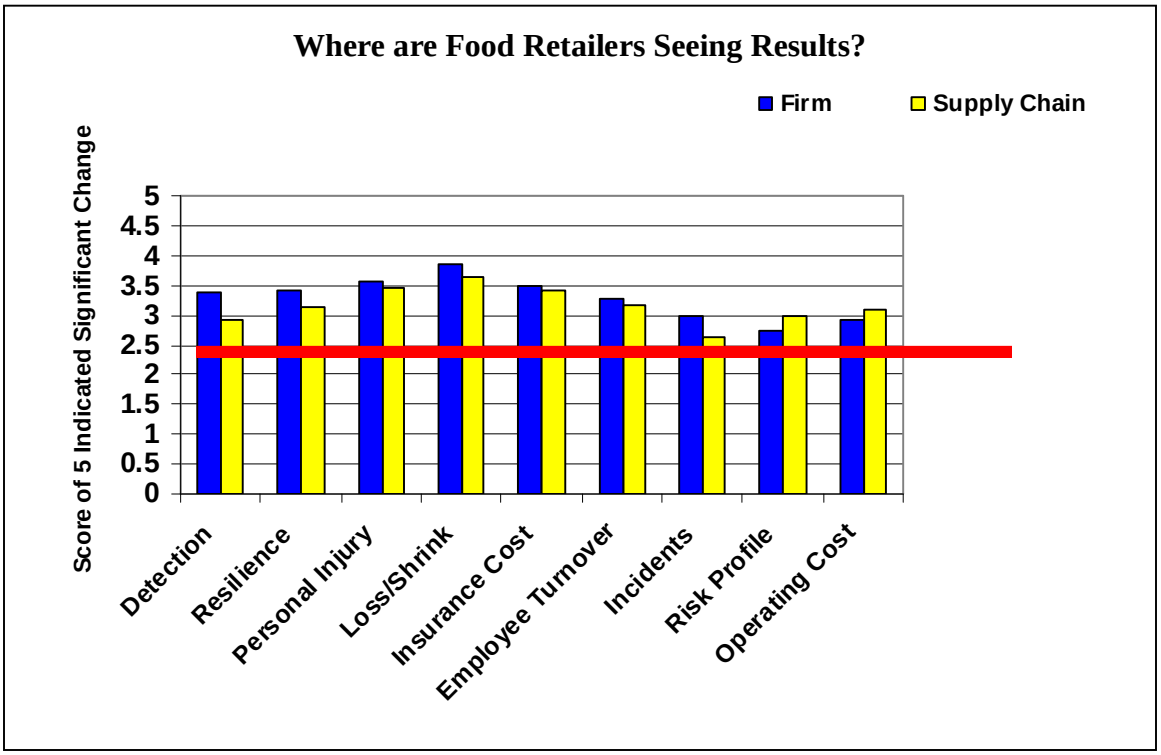
PERFORMANCE CHANGES IN THE FACE OF DEFENSE PRACTICES

The second set of questions in the survey focused on what *perceived* performance changes are linked to defense initiatives and practices in the first part of the survey. The results from these questions were used to answer the following questions: Do food supply chain defense initiatives make a difference? Are surveys participants seeing benefits?

The scale for these questions ranges from 1 (significant reduction or worse result) to 5 (significant increase or better result) in the performance criteria being measured. A value of 3 indicated no perceptible change, thus any value above 3 begins to indicate an improvement in the evaluated criteria.

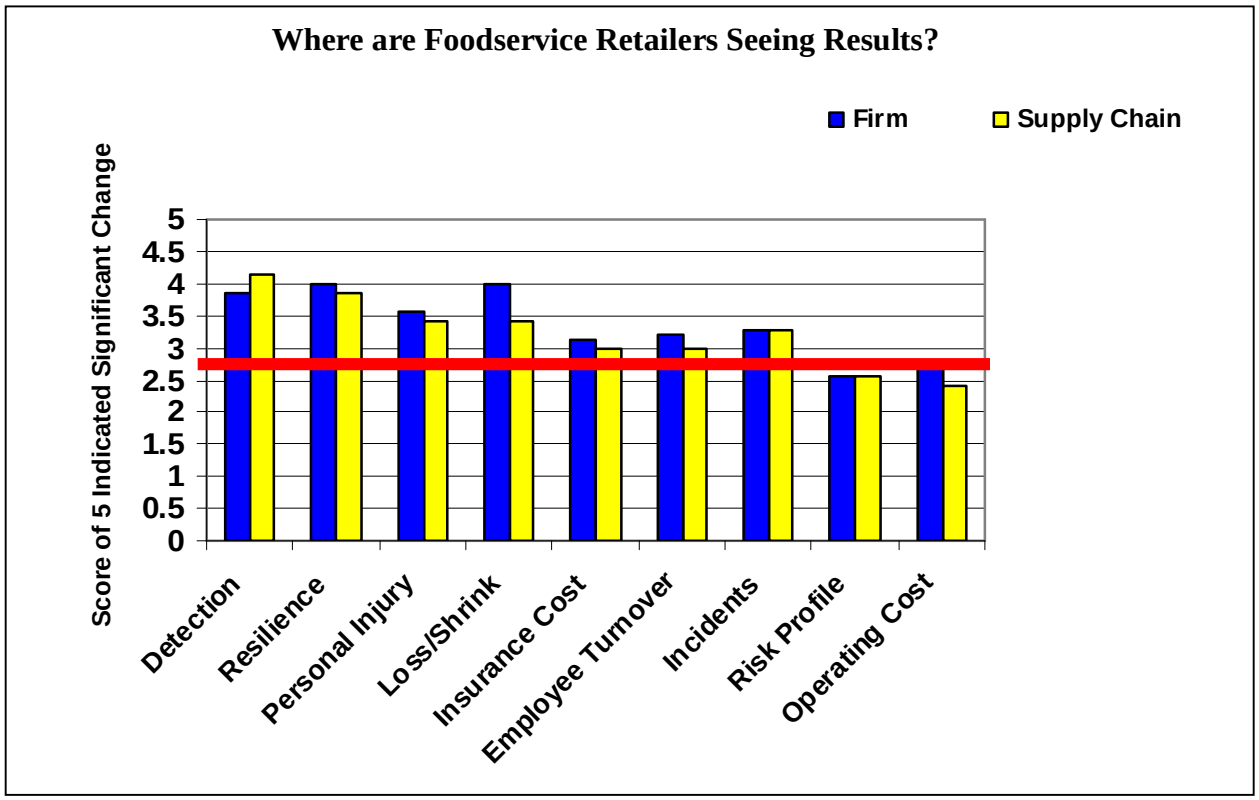
The following five tables, Table 11a – 11e, demonstrate the *perceived* changes in the detection and resilience to food incidents by the firms completing the survey and their supply chain partners.

TABLE 11a



The results from the Retail Food sector show the most evaluated areas received scores indicating a mild improvement (scores above 3). The largest perceived improvement occurred in the area of loss/shrink prevention. While the lowest improvement, and in some cases a mild deterioration, was perceived in the firms' risk profile demonstrating that firms believed their operations have become more risky. By evaluating the perceived effects on the supply chain as a whole, the results are rather similar to those of the individual firms' perceptions (though are slightly lower), except in the case of risk profile and operating costs, where the supply chain demonstrated better perceived results. These results indicate that retail food firms believe they are doing better than their suppliers or than their relationships with their suppliers.

TABLE 11b

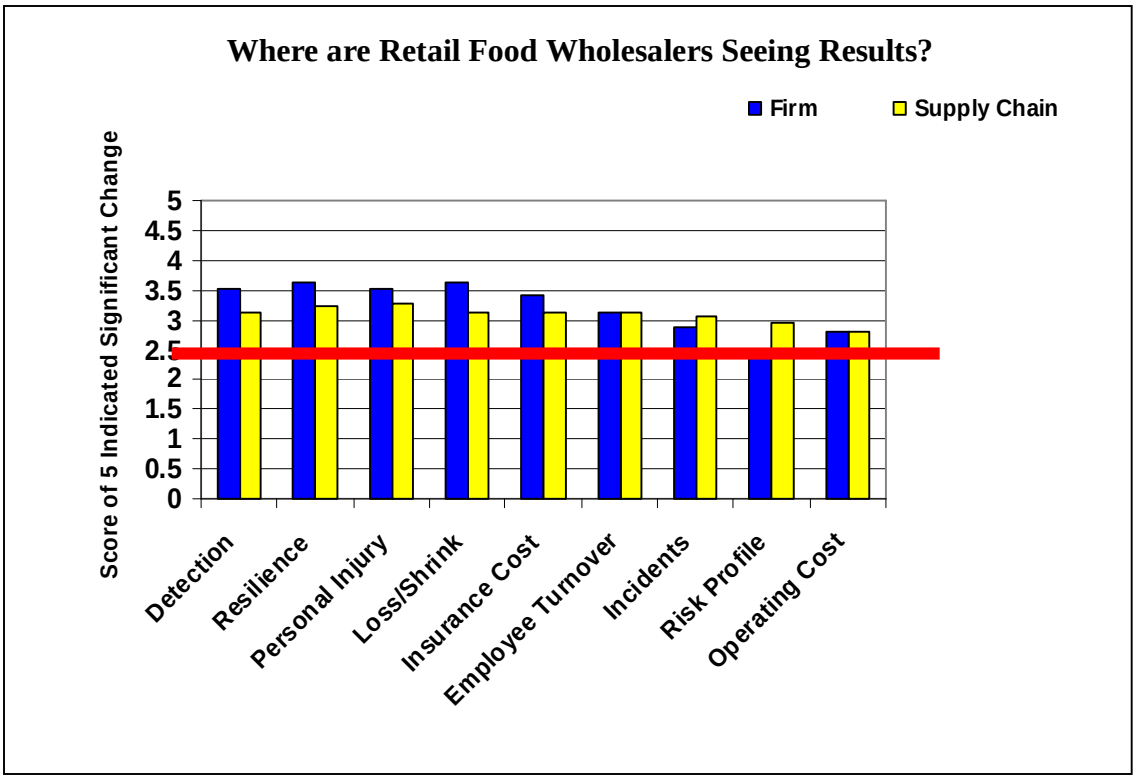


Results from the Foodservice Retail sector demonstrate that almost all of the evaluated

areas received scores indicating a perceived improvement (except risk profile and operating costs). The largest perceived improvement occurred in the area of loss/shrink prevention while the lowest improvement, and in some cases a mild deterioration, was perceived in the firms' risk profile. Evaluating the perceived effects on the supply chain as a whole, results are rather similar to that of the individual firms' perceptions (though are slightly lower). Except in the case of detection of security incidents, where the supply chain demonstrated a higher perceived improvement as compared to the individual firms.

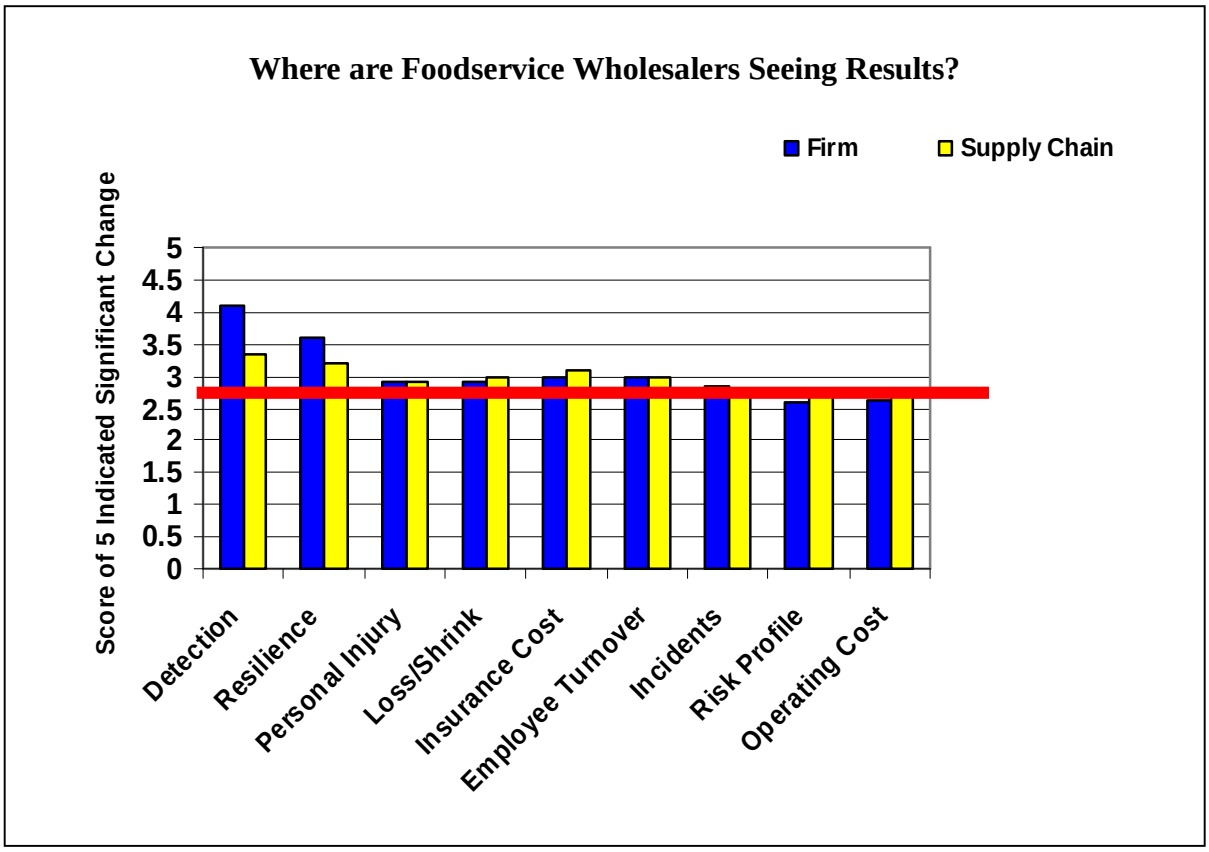
By comparing the retail sectors, the firms and supply chain members of the foodservice retail sectors perceive much larger improvements in their performance as a result of defense initiatives than do food retailers. This observation is consistent with the benchmark results presented earlier where the foodservice retail sector often had the highest competency scores. They had invested more in food defense and recovery and also perceived more benefits to that investment that did others.

TABLE 11c



Results from the Retail Food Wholesale sector show most of the evaluated areas received scores indicating a mild improvement. The largest perceived improvement occurred in the area of loss/shrinkage prevention and resilience, while the lowest improvement and in some cases a mild deterioration was perceived in the firms' risk profile and operating costs. Evaluating the perceived effects on the supply chain as a whole, results indicate no perceived change as a result of implementing security and defense efforts. The only slight improvement was observed in the area of resilience and the number of personal injuries.

TABLE 11d

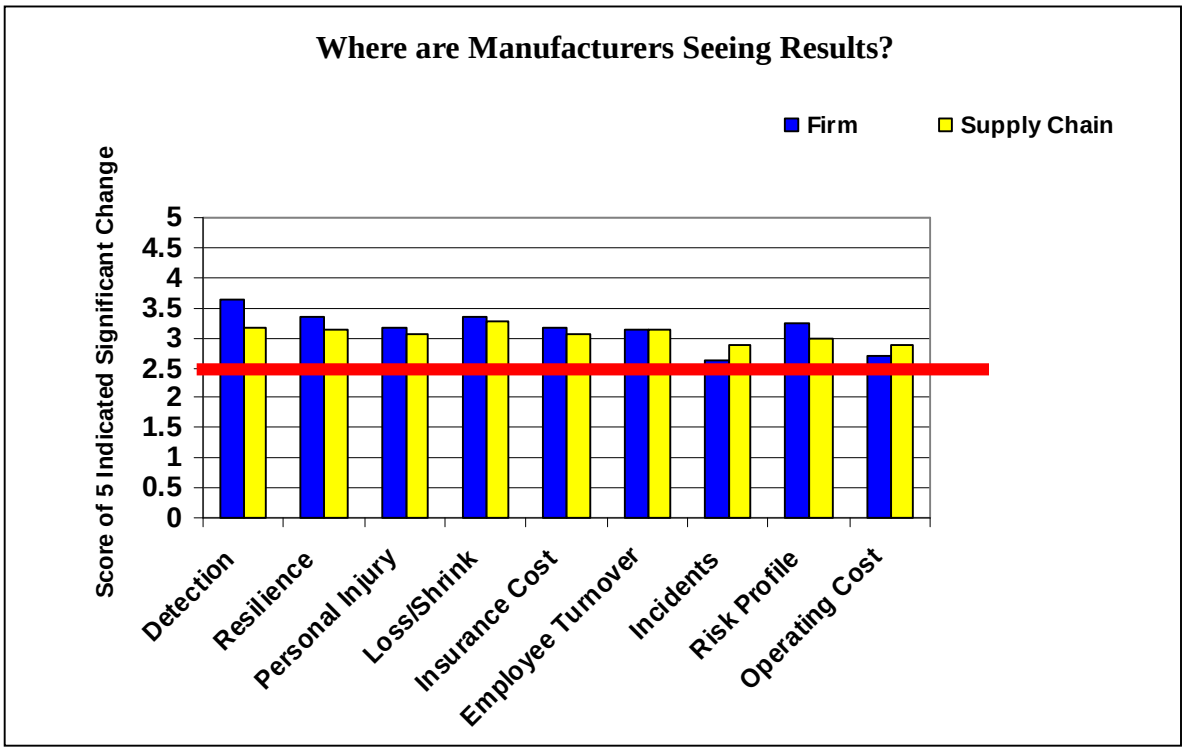


Results from the Foodservice Wholesale sector show only security incidents detection and resilience scores indicate an improvement of note; all of the other areas demonstrate no change or even mild deterioration. The largest perceived improvement occurs in the area of security incidents detection while the lowest improvement, and in some cases a mild deterioration, was perceived in the firms' risk profile. Evaluating the perceived effects on the supply chain as a whole shows the largest perceived improvement was in the detection of security incidents while no improvement and occasionally a slight deterioration was perceived in the area of risk profile.

A comparison of the Retail Food and Foodservice Wholesaler sectors demonstrates that once again the firms and supply chain members of the Foodservice sectors observe much larger

perceived improvements in their performance, resulting from their security and defense efforts as compared to the Food Retailers and their supply chain partners. This observation reflects a lower level of investment in food defense practices by the retail food sector and their suppliers compared to the foodservice sector.

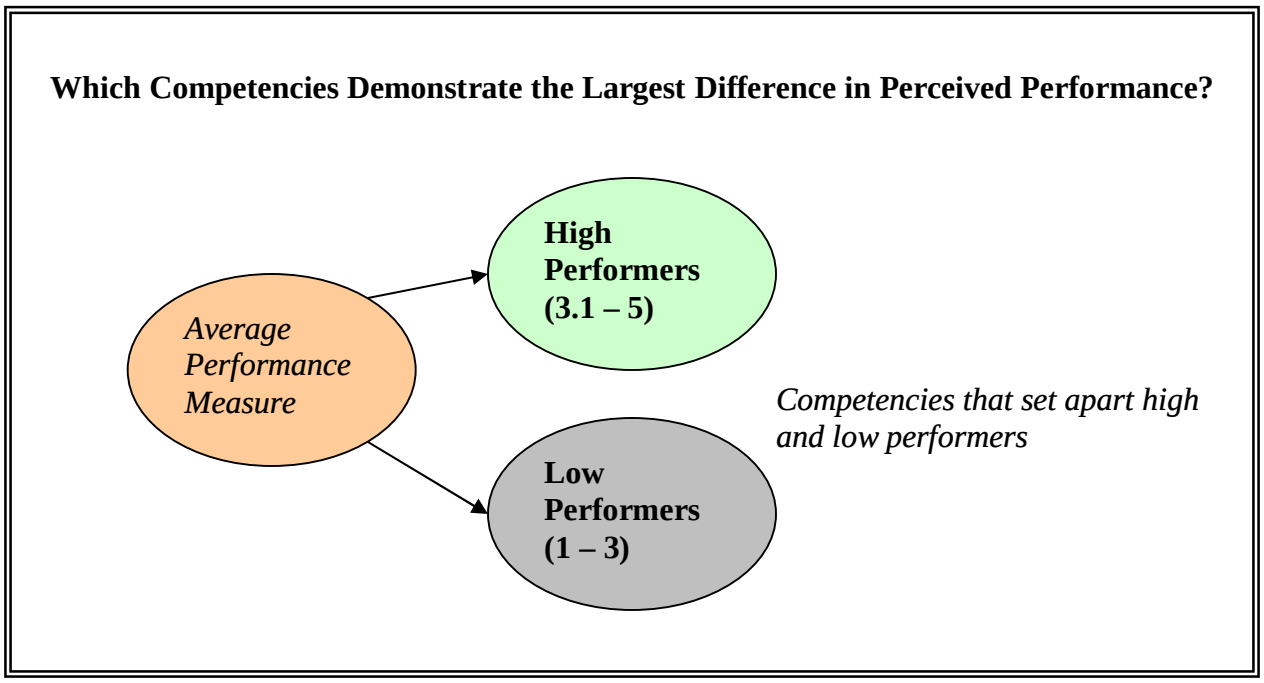
TABLE 11e



Results from the Manufacturers sector reveal that almost all of the evaluated areas received scores indicating a mild improvement. The largest perceived improvement occurred in the area of security incidents detection, while the lowest improvement and in some cases a mild deterioration was perceived in the number of security incidents. Evaluating the perceived effects on the supply chain as a whole shows the largest perceived improvement was in the reduction of loss/shrink while the no improvement, and occasionally a slight deterioration, was perceived in the number of security incidents.

Next we asked which competencies make the most difference. Do better practices result in a better perceived performance or are they at least correlated with better practices? Since the responses to all questions were collected simultaneously, it is impossible to determine that defense practices *caused* better performance, but we can tell if they are correlated in the minds of the respondents. For this analysis, the performance responses were organized into two groups: the high performers (those that responded 3.1 to 5 on the perceived performance questions) and the low and no change performers (those that responded 1 through 3). In effect, the analysis separated the high and not-so-high performers as illustrated in Figure 4.

FIGURE 4



Conducting such a comparison, one would expect that the competency and performance scores would be correlated since better practices are expected to result in a better *perceived* performance. Table 12 contains the overall average competency scores and *perceive*d performance scores for the five food industry sectors.

TABLE 12

Perceived Performance: Comparing MSU and Operational Defense Competencies

	Perceived Performance (avg)	MSU Competency Scores (avg)	Operational Defense Competency Scores (avg)
Retail Food	3.22	3.08	3.35
Foodservice Retail	3.32	3.81	3.90
Retail Food Wholesalers	3.15	3.09	3.32
Foodservice Wholesalers	2.96	3.51	3.67
Manufacturing	3.09	3.28	3.53

Table 12 shows that Retail Food and their Wholesale partners' performance and operational defense competency scores are rather similar (3.22 and 3.15 performance and 3.35 and 3.32 OD Competency), suggesting that for this sector, food defense efforts are directly reflected in the perceived performance scores. However, original (MSU) competency scores are lower than perceived performance scores suggesting the presence of an unobserved factor influencing the performance scores. These factors may have been picked up in the additional questions in the longer survey used for the retail and wholesale sectors survey at the University of Minnesota.

In the case of the Foodservice Retail, Wholesalers, and Manufacturing sectors, the average of the competency scores are higher than the perceived performance scores indicating that higher food defense measures are not resulting in higher perceived performance. The reason behind this phenomenon could be that food defense measures indicated in the competency scores were implemented rather recently and thus their effects were simply not yet observed. The issue of "time delay" (the fact that questions querying defense initiatives and resulting performance changes were asked simultaneously) could also be complicating the relationship between these

variables and thus not allowing for a clear identification of the link between them. It is also possible that having implemented more defense practices, foodservice companies had higher expectations for better performance and were not seeing the benefits they expected, or it is possibly too early to tell.

Regression analysis of the perceived performance on the defense practices reveals a link between the various defense measures and perceived improvement in insurance costs, loss/shrink, and risk profile, three of the four leading benefits of tighter defense/security practices (Kaynts, 2007) In her Plan B Master's Degree paper Kateryna Kaynts reports the following: (Paraphrased)

> *Analyzing the relationships between defense measures (ODC competencies) and perceived changes in insurance costs, shows that the strongest, statistically significant, impact is in lower perceived insurance costs influenced by the (ODC) competencies of Physical Security, Communication, Supply Chain Collaboration and Supply Chain Verification competencies. Thus, it can be concluded that investing in these defense practices, foodservice and retail food companies and their wholesalers could expect to experience a return on their investment in the form of reduced insurance costs.*
>
> *Aiming to determine the most effective (ODC) competencies correlated with a reduction in loss/shrink, regression analysis illustrates that investing in defense competencies included in Supply Chain Verification, foodservice and retail food companies and their wholesalers perceived a decline in their loss/shrink levels. In the case of resilience, the only competency demonstrating a statistically significant perceived influence in improving resilience in recovering*

from security incidents is Supply Chain Collaboration. Lastly, evaluating the relationship between the defense practices and risk profile, regression analysis revealed the fact that investing in Physical Security and Supply Chain Collaboration is significantly correlated with a perceived improvement of a firm's risk profile with respect to insurability and operations integrity. Combining the above finding , it can be concluded that investing in these defense measures food industry members would not only strengthen their food defense and lower insurance premiums, but could possibly obtain a measurable return on their investments.

Food defense practices captured under the competencies of Physical Security, Supply Chain Collaboration and Verification have the most notable impacts on the perceived positive benefits of investment. Food defense practices captured under Strategy and Security Protocols and Training of employees are also correlated with perceived performance but the perceived impact was **to increase costs** *of insurance, loss/shrink levels, and the risk profile. (Kaynts, 2007)*

DEMOGRAPHICS OF FOOD FIRMS – WHO PERFORMS THE BEST?

To determine if demographic attributes make a statistically significant difference on the way respondents answer defense measure questions, an analysis of variance using *a pair wise* comparisons, with a Bonferroni adjustment (BON) for doing multiple tests, was performed. The better they perform on the competencies the more resilient they are assumed to be for the following analysis. Analyzing the difference between the mean responses to the defense practices questions *within each competency* and the respondents' demographic variables, it is

evident that certain demographic characteristics account for statistically significant different defense practices (on a 5 percent level), as compared – pair wise, one at a time - to firms with different characteristics *within* each of the competencies.

The following tables 13a – 13e are the results of the Bonferroni tests for *only* the demographic variables exhibiting statistically significant different mean responses. For example, the first variable in Table 13a, 2.08, is the mean difference between the companies with revenues of $100-500M and $500M-$1B. This shows that companies with $100-500M annual revenue have a mean score in the audits/metrics competency that is 2.08 higher than the mean responses of firms whose revenue is between $500M -$1B and that difference is statistically significant at the 95% level of confidence. This could also be interpreted as smaller companies exhibiting a statistically significantly higher focus on the audits and metrics competency as compared to somewhat larger companies with revenue of $500 million to $1 billion. In each row, the first firm demographic characteristic named is the one that has a significantly higher mean value than the second characteristic mentioned. Also, the bigger the number in the column "Difference Between Means" (average) the "better" the firms listed first in the row performed relative to their comparison group.

Tables 13a-13e:
Statistically Significant Firm Demographics that Identify Better Resilience to Food Terrorism

TABLE 13a

Bonferroni (Dunn) t test for Resilience by Firm Demographics				
Annual revenue of the company	*Difference Between Means (avg)*	*Simultaneous 95% Confidence Limits (avg)*		*Area of Influence*
100-500M vs 500M-1B	2.08	0.08	4.07	Audits/Metrics
500M - 1B vs 20-100M	1.79	0.08	3.50	Audits/Metrics
over 1B vs 20-100M	1.50	0.11	2.90	Audits/Metrics
over 1B vs 500M-1B	1.85	0.06	3.64	Audits/Metrics
500M vs100-500M	2.14	0.89	3.38	Communication
500M vs 20-100M	1.54	0.11	2.98	Communication
over 1B vs 100-500M	1.49	0.56	2.42	Communication
over 1B vs 20-100M	1.40	0.13	2.67	Communication
over 1B vs 100-500M	1.09	0.13	2.05	Physical Security
500M vs 20-100M	1.63	0.03	3.22	Strategy/Security Protocols
over 1B vs 100-500M	1.26	0.15	2.37	Strategy/Security Protocols
over 1B vs 20-100M	1.40	0.25	2.56	Strategy/Security Protocols
over 1B vs 100-500M	0.86	0.08	1.64	Supply Chain Collaboration
over 1B vs 20-100M	0.85	0.05	1.65	Tracking/Monitoring
500M - 1B vs 20-100M	2.17	0.51	3.74	Training
over 1B vs 20-100M	1.52	0.18	2.86	Training

TABLE 13b

Bonferroni (Dunn) t test for Resilience by Firm Demographics				
Organization's tax status	*Difference Between Means (avg)*	*Simultaneous 95% Confidence Limits (avg)*		*Area of Influence*
Cooperative vs For Profit	1.04	0.05	2.04	Physical Security
For Profit vs Other	1.58	0.04	3.12	Physical Security

TABLE 13c

Bonferroni (Dunn) t test for Resilience by Firm Demographics				
Firm's market area	*Difference Between Means (avg)*	*Simultaneous 95% Confidence Limits (avg)*		*Area of Influence*
National vs Regional	1.26	0.07	2.44	Audits/Metrics
Global vs Regional	1.53	0.21	2.86	Audits/Metrics
Global vs Local	2.25	0.14	4.36	Audits/Metrics
Global vs Regional	1.34	0.13	2.54	Supply Chain Collaboration
Global vs Local	2.33	0.14	4.53	Supply Chain Collaboration
Global vs Regional	1.68	0.37	2.99	Supply Chain Verification
Global vs Local	2.35	0.25	4.45	Supply Chain Verification
Global vs Regional	1.51	0.20	2.83	Tracking/Monitoring

TABLE 13d

Bonferroni (Dunn) t test for Resilience				
Firm's supply chain scope	*Difference Between Means (avg)*	*Simultaneous 95% Confidence Limits (avg)*		*Area of Influence*
Global vs Local	3.27	0.37	6.17	Communication
National vs Local	2.90	0.16	5.64	Communication
Regional vs Local	3.10	0.37	5.83	Communication
Global vs Local	3.15	0.50	5.80	Strategy/Security Protocols
National vs Local	2.89	0.33	5.45	Strategy/Security Protocols
National vs Local	3.47	1.02	5.91	Tracking/Monitoring
Regional vs Local	3.45	1.00	5.90	Tracking/Monitoring

TABLE 13e

Bonferroni (Dunn) t test for Resilience by Firm Demographics				
Firm's primary scope of activities	*Difference Between Means (avg)*	*Simultaneous 95% Confidence Limits (avg)*		*Area of Influence*
Food Retailer vs Foodservice Wholesaler	1.33	0.10	2.57	Audits/Metrics
Food Retailer vs Retail Wholesaler	1.38	0.24	2.15	Audits/Metrics
Foodservice Retailer vs Food Retailer	1.88	0.70	3.07	Audits/Metrics
Foodservice Retailer vs Retail Wholesaler	1.83	0.57	3.08	Audits/Metrics
Foodservice Wholesale vs Food Retail	1.67	0.23	3.11	Audits/Metrics
Foodservice Retail vs Retail Wholesaler	1.57	0.20	2.94	Communication
Foodservice Wholesale vs Retail Wholesaler	1.39	0.25	2.52	Communication
Foodservice Retailer vs Food Retailer	1.35	0.34	2.36	Physical Security
Foodservice Retailer vs Retail Wholesaler	1.50	0.20	2.72	Strategy/Security Protocols
Foodservice Wholesale vs Food Retail	1.18	0.13	2.22	Strategy/Security Protocols
Foodservice Retailer vs Food Retailer	2.02	0.59	3.45	Supply Chain Collaboration
Foodservice Retailer vs Foodservice Wholesaler	1.70	0.20	3.10	Supply Chain Collaboration
Foodservice Retailer vs Retail Wholesaler	1.59	0.35	2.83	Supply Chain Collaboration
Foodservice Retailer vs Food Retailer	1.71	0.49	2.94	Supply Chain Verification
Foodservice Retailer vs Foodservice Wholesaler	1.51	0.30	2.72	Supply Chain Verification
Foodservice Retailer vs Retail Wholesaler	1.76	0.54	2.99	Supply Chain Verification
Food Retailer vs Retail Wholesaler	1.36	0.03	2.69	Tracking/Monitoring
Foodservice Retailer vs Food Retailer	1.43	0.45	2.40	Tracking/Monitoring
Foodservice Wholesale vs Food Retail	1.37	0.36	2.38	Tracking/Monitoring

The results show the magnitude of a company's annual revenue, its tax status, market area, supply chain scope and its primary scope of activities, exhibiting a statistically significant impact on the way the survey participants answered the questions, thus creating statistically significantly different competency results. In the case of *annual revenue (Table 13a),* a positive relationship could be observed between all seven of the competency questions and the firm's annual revenue indicating that companies with higher annual revenues tend to focus more closely on seven of the competencies (in the right hand column). This observation could also indicate that larger companies, in terms of their revenue, most likely have more financial and human resources to invest in defense measures thus scoring higher on the evaluated competencies. In

the case of an *organization's tax status (table 13b),* cooperative organizations are exhibiting a higher focus on the elements of Physical Security compared to for-profit companies. For-profit companies do better on physical security than all other tax status companies, other than cooperatives. This is the only competency for which there are significant differences between firms with various types of tax status. Building on this observation, it could be reasoned that cooperative organizations are not competing in the same narrow margin, "cut throat" markets that the for-profit food companies do, thus allowing them to spend more on physical security related matters. Moreover, as cooperative organizations do not have to account for their investment activities to the market or their shareholders, they can afford to make forward-looking strategic decisions even if they result in short-term financial loses.

The *firm's market area (Table 13 c)* indicates that the larger the area the higher the benchmark mean scores in the competencies of Audits/Metrics, Supply Chain Collaboration and Verification and Tracking/Monitoring. In supply chain collaboration, global companies were better than the local or regional companies, but there was not a significant difference between national or global companies. It is reasonable that companies with longer supply chains will have more collaboration with their supply chain partners, likewise for Supply Chain Verification. The *supply chain scope (Table 13d)* indicates that a larger area of operations positively correlates with scores in Communication, Strategy/Security Protocols and Tacking/Monitoring competencies. The reason for this result could be that in order to be successful in a more geographically wide-spread area of operations, an organization has to make a proportionally larger investment into these competencies. Without well defined Communication Protocols, Audits, Tracking and Collaboration activities, the communication and operating activities of a company would fail regularly causing monetary and reputation losses. Thus, to maintain their

competitiveness and financial health, it is not surprising that organizations with a wider scope of activities are observed to allocate greater resources to these measures.

The *firm's primary scope of activities (Table 13e)* once again plays a significant role in a food company's allocation of food defense resources. The Bonferroni analysis further demonstrates the statistically significant difference between Foodservice Retailers, Wholesaler and Retail Food companies and their wholesale partners. As in the case of competency analysis, the test validates the previously discussed observation regarding Foodservice Retailers and their Wholesale partners as food industry leaders in food defense measures and practices. Only in Audits/Metrics did Food Retailers outperform Foodservice and Retail Food Wholesalers.

CONCLUSIONS

Food defense is a rather new area of study, however, with each year its importance is becoming more and more relevant to food supply chain operations and integrity. The main value of this study lies in identifying the most critical practices for food defense, calculating the industry sector average and leaders for each competency, and developing a diagnostic tool which will allow any food industry member to determine their food defense preparedness and identify areas in need of further improvement. Using the data provided by the Benchmarking Survey, the study was able to rank the level of engagement in food defense practices by various sectors of the industry and found that Foodservice Retailers are the leaders, followed by Foodservice Wholesalers, Food Retailers and their Wholesale partners.

Based on the results of the survey, this research identified the 43 most important questions that underlie the competencies, the combination of which is sufficient to allow any food industry member to compare its food defense activities to its sector's industry average or

leader. The competency scores identified by this study benchmark the operational areas in need of improvement. These scores form the foundation of a Diagnostic Tool available to all food companies for use benchmarking their practices against their industry peers. The study was also able to determine some underlying differences between food industry members based on size and scope of operations or tax status. By identifying the influence of these demographic characteristics, company representatives' answers to the survey questions further highlighted the range of food industry activities in the area of food defense and the importance of understanding these variations. In general, companies with larger revenue, cooperatives and those with a larger market scope are more engaged in food defense practices. Individual companies are doing better internally than they are doing with their suppliers or than they perceive their suppliers to be doing. Cross supply chain communication about practices will be very important to continue to improve food defense practices and further strengthen the U.S. farm-to-fork supply chain continuum.

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Appendix I

NATIONAL CENTER FOR
FOOD PROTECTION AND DEFENSE
A HOMELAND SECURITY CENTER OF EXCELLENCE

Supply Chain Security Benchmarking and Assessment Survey Questionnaire

Conducted by:

The Food Industry Center
UNIVERSITY OF MINNESOTA

2006

J.D. Kinsey, Professor and Co-director
J. Seltzer, Consultant
C. Friddle Ph.D. Candidate

PRIMARY PRODUCTION > HARVEST > TRANSPORTATION > STORAGE > PROCESSING > RETAIL/FOOD SERVICE > CONSUMER

By completing this survey you and other food companies will enable us to construct a benchmarking tool which food companies like yours will be able to use to assess their preparedness to defend their companies and the food they handle against terrorist attacks. You may complete this survey in the attached booklet or via the Internet. The Internet address and your **pin number** are located on the stickers affixed to the cover letter and this booklet. The **pin number** will allow you to log on and pull up the questionnaire and complete it in one or more sittings. The total survey will take you about forty minutes. If you prefer to complete it by filling out the answers in this booklet, please do so and mail it back in the self-addressed envelope provided for that purpose.

The University of Minnesota and all personnel involved with this project are devoted to protecting company specific data and at no time or place will companies who participate or their individual responses be identified. The records of this study will be kept private. No report we produce will include any information that will make it possible to identify a respondent. Research records will be stored securely and only researchers will have access to the records. The pin number identification and your survey responses will be housed in separate databases in order to ensure confidentiality.

The benefits of participation include an immediate check list for you to use to assess your preparedness and a complimentary copy of the benchmarking tool when it is completed – assuming you request it in a separate call or email after submitting your data. (This will further ensure the anonymity of your responses.) In addition, if you wish, **extra pin numbers** can be created for your company to have different operating units or regional divisions complete their own assessments of security. If you would like extra pin numbers or more information on this project, please contact Charlotte Friddle at fridd001@umn.edu or call 651-247-8365.

This work is funded by The National Center for Food Protection and Defense (NCFPD), a Homeland Security Center of Excellence. It is conducted by The Food Industry Center at the University of Minnesota in collaboration with Michigan State University and Georgia Institute of Technology. The researchers conducting this phase of the study are J.D. Kinsey, J. Seltzer and C. Friddle. If you have questions, you are encouraged to contact them at the number above or contact J.D. Kinsey at 612-625-2744 or jkinsey@umn.edu.

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher(s), you are encouraged to contact the Research Subjects' Advocate Line, D528 Mayo, 420 Delaware St. Southeast, Minneapolis, Minnesota 55455; (612) 625-1650.

Participation in this study is voluntary. Your decision whether or not to participate will not affect your current or future relations with the University of Minnesota or the research centers conducting this study. If you decide to participate, you are free to not answer any question or withdraw at any time with out affecting those relationships.

Completing and submitting the survey constitutes your consent to participate. See the glossary at the end if you need definition of terms.

Thank you in advance for deciding to assess your company's performance and planning related to food defense and security. A safe and reliable food supply is essential to the health and welfare of the U.S. population. You are helping to make it so.

INSTRUCTIONS: Please read each statement carefully and circle the number that most closely corresponds to your level of agreement with the statement. If you strongly disagree with the statement, circle 1. If you strongly agree, circle 5. If the statement does not apply to your firm or you do not know, please circle 6 under N/A. Please note that the term "firm" refers to your organization. A glossary of certain terminology is provided at the end of the survey to help clarify the questions.

Thank you for your time in responding to this survey. Your participation is important to understand how U.S. companies are addressing food protection and defense. Your responses will be confidential and anonymous.

		Strongly Disagree				Strongly Agree	N/A
1	Our firm has established access control for *employees* to ensure the integrity of facilities and operations.	1	2	3	4	5	6
2	Our firm has established access control for *non-employees* to ensure the integrity of facilities and operations.	1	2	3	4	5	6
3	Our firm has established restrictive controls (restriction of personal items in sensitive areas, restriction of non-essential chemicals in sensitive areas, etc…) to ensure the integrity of facilities, operations, and food products.	1	2	3	4	5	6
4	Our firm has defined communication protocols consistent with the National Incident Management System (NIMS) (i.e. federal protocol to handle security incidents).	1	2	3	4	5	6

5	Our firm's information systems provide managers the *timely* information they need to respond to contamination/security incidents.	1	2	3	4	5	6
6	Our firm's information systems provide managers *valid* information they need to respond to contamination/security incidents.	1	2	3	4	5	6
7	Our firm utilizes food and material security audit/certification programs.	1	2	3	4	5	6
		Strongly Disagree				Strongly Agree	N/A
8	Our firm has specific education programs for our supply chain partners regarding supply chain security procedures.	1	2	3	4	5	6
9	Our firm complies with government-required record keeping regulations in the event of a potential terrorist threat or actual terrorist incident.	1	2	3	4	5	6
10	Our firm verifies that our suppliers and transporters use government or industry security guidelines.	1	2	3	4	5	6
11	Our firm's senior management views supply chain security as necessary for protecting our brand or reputation.	1	2	3	4	5	6
12	Our firm has the ability to track and trace products one supplier up and one customer down the supply chain.	1	2	3	4	5	6
13	Our firm uses an external audit team (as opposed to self-audits) to verify the security procedures of our supply chain partners.	1	2	3	4	5	6

14	Our firm collaborates with suppliers and transporters to improve their security programs.	1	2	3	4	5	6
15	Our firm has decision trigger points and/or automated response actions in the event of a contamination/security incident.	1	2	3	4	5	6
16	Our firm utilizes security metrics as part of an overall brand protection program.	1	2	3	4	5	6
17	Our firm has defined consequences for supply chain partners who fail to comply with supply chain security procedures.	1	2	3	4	5	6
	Use for Questions 18 through 21 Our firm's supply chain security metrics were developed based on ____ guidelines.						
		Strongly Disagree				Strongly Agree	N/A
18	*Government*	1	2	3	4	5	6
19	*Industry*	1	2	3	4	5	6
20	*Internal*	1	2	3	4	5	6
21	*Key supply chain partner*	1	2	3	4	5	6
22	Our firm has a senior management position focusing on security (e.g., Director of Security, Chief Security Officer).	1	2	3	4	5	6
23	Our firm incorporates information on preventing a deliberate contamination incident into employee food security awareness training.	1	2	3	4	5	6

24	Our firm has the technology to track food products including donations, salvage, reworked, and returned products.	1	2	3	4	5	6
25	Our firm's information systems allow us to quickly share appropriate information to all firm employees in case of contamination/security incidents.	1	2	3	4	5	6
26	Our firm has established a communication strategy for providing information about contamination/security incidents to the appropriate *government/public agencies*.	1	2	3	4	5	6
27	Our firm has established a communication strategy for providing information about contamination/security incidents to the *media/public*.	1	2	3	4	5	6
28	Our firm has established a communication strategy for providing information about contamination/security incidents to our *supply chain partners*.	1	2	3	4	5	6
		Strongly Disagree				Strongly Agree	N/A
29	Our firm participates in food security preparations with external public health groups (e.g. U.S. Public Health Service, Center for Disease Control).	1	2	3	4	5	6
30	Our firm verifies that our suppliers and transporters perform security background checks on their employees.	1	2	3	4	5	6
31	Our firm has defined procedures to complete product recalls.	1	2	3	4	5	6
32	Our firm's senior management supports food supply chain security initiatives.	1	2	3	4	5	6

33	Our firm regularly conducts security audits to determine weaknesses in physical security.	1	2	3	4	5	6
34	Our firm uses an enterprise-wide strategy to address security concerns.	1	2	3	4	5	6
35	Our *firm's* information systems are secure.	1	2	3	4	5	6
36	Our *supply chain partners'* information systems are secure.	1	2	3	4	5	6
37	Our firm uses radio frequency identification (RFID) to effectively track the products in our control.	1	2	3	4	5	6
	<u>Use for Questions 38 through 43</u> Our firm's information systems allow us to provide any and all of the following information within 24 hours, if requested by the FDA, for each food item transported within the past year:						
		Strongly Disagree				Strongly Agree	N/A
38	*The name of the immediate previous source and immediate subsequent recipient.*	1	2	3	4	5	6
39	*The origin and destination points.*	1	2	3	4	5	6

40	*The date the shipment was received and released*	1	2	3	4	5	6
41	*Number of packages in the shipment*	1	2	3	4	5	6
42	*Description of freight*	1	2	3	4	5	6
43	*Route of movement and transfer points through which the shipment moved.*	1	2	3	4	5	6
44	Our firm participates in emergency-preparedness planning with appropriate government agencies.	1	2	3	4	5	6
45	Our firm verifies that suppliers and transporters monitor transportation assets.	1	2	3	4	5	6
46	Our firm has strategically assessed our supply chain protection capabilities for *domestic* supply chain partners.	1	2	3	4	5	6
47	Our firm has strategically assessed our supply chain protection capabilities for *international* supply chain partners.	1	2	3	4	5	6
48	Our *loaded* trailers and containers are stored in a secure environment.	1	2	3	4	5	6
49	Our *empty* trailers and containers are stored in a secure environment.	1	2	3	4	5	6
50	Our firm's information systems provide our supply chain partners with the *timely* information they need to respond to contamination/security incidents.	1	2	3	4	5	6
		Strongly Disagree				Strongly Agree	N/A
51	Our firm's information systems provide our supply chain partners with *valid* information they need to respond to contamination/security incidents.	1	2	3	4	5	6

52	Our firm's supply chain partners collaborate in the use of radio frequency identification (RFID) to track products throughout the supply chain.	1	2	3	4	5	6
53	Our firm maintains a database containing emergency contact information for all of our suppliers and transporters.	1	2	3	4	5	6
54	Our firm participates in emergency-preparedness testing (table top, field exercises, etc…) of plans with appropriate government agencies.	1	2	3	4	5	6
55	Our firm has identified transportation vulnerabilities from point of origin to final destination (including shipping modes/routes).	1	2	3	4	5	6
56	Our firm has implemented supply chain *security metrics* based on compliance with government agency guidelines (e.g. Food and Drug Administration, U.S. Department of Agriculture).	1	2	3	4	5	6
57	Our firm's senior management views supply chain security as a competitive advantage.	1	2	3	4	5	6
58	Our firm has established consequences for employees who fail to comply with internal security procedures.	1	2	3	4	5	6
59	Our firm uses global positioning systems (GPS) to track containers containing products for which we are responsible.	1	2	3	4	5	6
60	Our *firm's* transportation assets are *locked* while in transit.	1	2	3	4	5	6
61	Our *firm's* transportation assets are *sealed* while in transit.	1	2	3	4	5	6
62	Our *suppliers'* transportation assets are *locked* while in transit.	1	2	3	4	5	6

63	Our *suppliers'* transportation assets are *sealed* while in transit.	1	2	3	4	5	6
64	Our firm utilizes the Hazard Analysis and Critical Control Point (HACCP) system.	1	2	3	4	5	6
65	Our firm regularly assesses the qualifications and credentials of security personnel.	1	2	3	4	5	6
	<u>Use for Questions 66 through 69</u> Our firm incorporates information on _____a contamination/security incident into employee food protection training.						
		Strongly Disagree				Strongly Agree	N/A
66	*Preventing*	1	2	3	4	5	6
67	*Detecting*	1	2	3	4	5	6
68	*Responding to*	1	2	3	4	5	6
69	*Recovering from*	1	2	3	4	5	6
70	Our firm has defined *internal* communication protocols in case of a contamination/security incident.	1	2	3	4	5	6
71	Our firm has defined *external* reporting protocols for contamination/security incidents.	1	2	3	4	5	6
72	Our firm uses closed circuit television (CCTV) to monitor activities on loading docks.	1	2	3	4	5	6
73	Our supply chain partners can provide us the information we need to respond to contamination/security incidents.	1	2	3	4	5	6

		Strongly Disagree				Strongly Agree	N/A
74	Our firm uses security assessments to determine if relationships should be maintained with *suppliers*.	1	2	3	4	5	6
75	Our firm uses security assessments to determine if relationships should be maintained with *customers*.	1	2	3	4	5	6
76	Our firm only uses suppliers and transporters with whom we have an established relationship.	1	2	3	4	5	6
77	Our firm performs background checks on all employees.	1	2	3	4	5	6
78	Our firm's senior management views supply chain security initiatives as a necessary cost of doing business.	1	2	3	4	5	6
	<u>Use for Questions 79 through 82</u> Our firm has processes in place to _____ a contamination/security event in our supply chain.						
		Strongly Disagree				Strongly Agree	N/A
79	*Prevent*	1	2	3	4	5	6
80	*Detect*	1	2	3	4	5	6
81	*Respond to*	1	2	3	4	5	6
82	*Recover from*	1	2	3	4	5	6
83	Our firm has implemented procedures to monitor receipt of products at our facilities.	1	2	3	4	5	6
84	Our firm conducts drills to test our supply chain protection capabilities.	1	2	3	4	5	6

		Strongly Disagree				Strongly Agree	N/A
	Use for Questions 85 through 89 Our firm's continuity plans consider the potential lack of availability of _____ in the event of a crisis.	1	2	3	4	5	6
85	*Power/Electricity*	1	2	3	4	5	6
86	*Transportation*	1	2	3	4	5	6
87	*Water*	1	2	3	4	5	6
88	*Communications*	1	2	3	4	5	6
89	*Internet*	1	2	3	4	5	6
90	Our firm requires transportation providers to provide advanced shipment notices [e.g. Advanced Shipment Notices (ASN's) or Advanced Manifest Requirements (AMR's)] before delivery.	1	2	3	4	5	6
91	Our firm audits the security procedures of *contract manufacturers.*	1	2	3	4	5	6
92	Our firm audits security procedures of *frequently used suppliers* (e.g. employee/driver background checks, origination and ownership, ingredients, and packaging procedures).	1	2	3	4	5	6
93	Our firm audits security procedures of *infrequently used suppliers* (e.g. employee/driver background checks, origination and ownership, ingredients, and packaging procedures).	1	2	3	4	5	6

94	Our firm audits the security procedures of *our customers* (e.g. employee/driver background checks, origination and ownership, ingredients, and packaging procedures).	1	2	3	4	5	6
95	Our firm generates routine exception reports (e.g. noncompliance reports, corrective action reports, potential incident reporting, and actual incident reporting).	1	2	3	4	5	6
96	Our firm uses technology (e.g. X-ray, RFID, etc…) to verify trailer or container contents.	1	2	3	4	5	6
97	Our firm monitors security metrics across the supply chain.	1	2	3	4	5	6

98	Our firm includes the contact information for local, state and federal government homeland security authorities and public health officials in our security plan.	1	2	3	4	5	6
99	Our firm stores hazardous materials/chemicals in secure storage areas.	1	2	3	4	5	6
100	Our firm locks loading docks and storerooms to avoid unverified and unauthorized deliveries.	1	2	3	4	5	6
101	Our firm's self-service areas such as bakery shelves, candy bins, soda dispensers, etc. are monitored for evidence of tampering or other contamination.	1	2	3	4	5	6
102	Our firm has restricted access to the controls for airflow, water, electricity, ice making machines and refrigeration.	1	2	3	4	5	6
103	Our firm verifies the credentials of employees of service providers such as those in pest control, daily maintenance, cleaning, etc.	1	2	3	4	5	6

104	Our firm controls access to vulnerable food processing and preparation areas, i.e. bulk tanks, open containers, deli counters.	1	2	3	4	5	6
105	Our firm uses on-site testing kits to detect product contamination.	1	2	3	4	5	6
106	Our firm has restrictions on personal items allowed outside of the employee lockers/breakroom, such as medications, purses, etc.	1	2	3	4	5	6
107	Our firm *rewards* employees that report suspicious activities.	1	2	3	4	5	6
108	Our firm understands the public's expectations of our enterprise during a crisis incident response.	1	2	3	4	5	6
109	Our firm uses tamper evident seals to reduce the chance of a product being adulterated.	1	2	3	4	5	6

SECTION 2

This part seeks background information about your job duties and your firm.

1. What is your title?

   [1] President (owner) [2] Vice-President [3] Director [4] Manager [5] Supervisor

   [6] Other (please specify)_____

2. Please circle the category that best describes your organizational responsibility.

   [1] Corporate [2] Divisional [3] Plant [4] Warehouse [5] Store

3. How many people are employed at your facility?

   < 50 50-99 100-199 200-499 >500

4. Please circle the category that best describes your main functional area (circle only one):

   [1] Operations [2] Quality Assurance [3] Security [4] Risk Management

   [5] Other (please specify)_____

5. How long have you worked:
   a. <u>in this industry</u> (in years)?

      0-1 2-4 5-9 10-14 15-19 > 19

   b. <u>for your current employer</u> (in years)?

      0-1 2-4 5-9 10-14 15-19 > 19

   c. <u>in your current position</u> (in years)?

      0-1 2-4 5-9 10-14 15-19 > 19

6. How many employees:

   a. work for your company in the United States?

0-100 101-500 501-1000 1001-5000 5001-20,000 20,001-50,000 >50,000

   b. work for your company internationally?

0-100 101-500 501-1000 1001-5000 5001-20,000 20,001-50, 000 >50,000

7. The annual revenue of your company is:

   < $20 Mil $20 Mil - $100 Mil $100 Mil - $500 Mil $500 Mil - $1Bil > $1Bil

8. Which best describes your firm's market area? (Check only one)

   [1] Local_____ [2] Regional_____ [3] National_____ [4] Global_____

9. Which best describes your firm's supply chain scope? (Check only one)

   [1] Local_____ [2] Regional_____ [3] National_____ [4] Global_____

10. Which best describes your firm's primary scope of activities? (check only one)

    [1] Manufacturing [2] Retail Wholesaler/Distributor [3] Foodservice Wholesaler/Distributor

    [4] Grocery Retailer [5] Foodservice Retailer [6] Logistics Service Provider

    [7] Other _____

11. Which best describes your organization's tax status?

    [1] For profit [2] Cooperative [3] Other_____

SECTION 3

NOTE: The following questions use a 1-6 scale with 1 being "Significantly Reduced", 3 being "No Change", 5 being "Significantly Increased" and 6 being "N/A"

		Significantly Reduced		No Change		Significantly Increased	N/A
1	Our firm's security investment has _____ our ability to detect security incidents:						
	(a) Inside our firm	1	2	3	4	5	6
	(b) Across the supply chain	1	2	3	4	5	6
2	Our firm's security investment has resulted in _____ security incidents:						
	(a) Inside our firm	1	2	3	4	5	6
	(b) Across the supply chain	1	2	3	4	5	6
3	Our firm's security investment has _____ our resilience in recovering from security incidents:						
	(a) Inside our firm	1	2	3	4	5	6
	(b) Across the supply chain	1	2	3	4	5	6
4	Our firm's security investment has _____ our risk profile with respect to insurability and operations integrity:						

	(a) Inside our firm	1	2	3	4	5	6
	(b) Across the supply chain	1	2	3	4	5	6
		Significantly Reduced		No Change		Significantly Increased	N/A
5	Within my firm, our security investment has led to:						
	(a) _____ operating costs	1	2	3	4	5	6
	(b) _____ loss/ shrink	1	2	3	4	5	6
	(c) _____ insurance costs	1	2	3	4	5	6
	(d) _____ personal injury incidents	1	2	3	4	5	6
	(e) _____ employee turnover	1	2	3	4	5	6
6	Within my supply chain, our security investment has led to:						
	(a) _____ operating costs	1	2	3	4	5	6
	(b) _____ loss/ shrink	1	2	3	4	5	6
	(c) _____ insurance costs	1	2	3	4	5	6
	(d) _____ personal injury incidents	1	2	3	4	5	6
	(e) _____ employee turnover	1	2	3	4	5	6
7	Relative to our major competitors, our security investment has:						
	(a) _____ cost.	1	2	3	4	5	6
	(b) _____ customer service.	1	2	3	4	5	6
	(c) _____ productivity.	1	2	3	4	5	6

	(d) _____ product quality.	1	2	3	4	5	6
8	Relative to our major competitors, our firm has been able to more effectively:						
		Significantly Reduced		No Change		Significantly Increased	N/A
	(a) _____ supply chain costs as a percentage of total costs	1	2	3	4	5	6
	(b) _____ service levels to customers	1	2	3	4	5	6
	(c) _____ our supply chain assets	1	2	3	4	5	6
NOTE: The following questions use a 1-6 scale with 1 being "Strongly Agree", 5 being "Strongly Disagree" and 6 being "N/A"							
		Strongly Agree				Strongly Disagree	N/A
9	Relative to our major competitors, our firm has been more effective at meeting the security expectations of:						
	(a) Our customers	1	2	3	4	5	6
	(b) The public	1	2	3	4	5	6
	(c) Government agencies	1	2	3	4	5	6

10	Within the last year, our firm has been able to meet the security expectations of:						
	(a) Our customers	1	2	3	4	5	6
	(b) The public	1	2	3	4	5	6
	(c) Government agencies	1	2	3	4	5	6

This is the final section. Thank you for completing the survey!

Open Ended Questions:

1. Our firm's annual investment in security is about _____% of gross revenue.

2. Our firm has _____(number) of new or reassigned employees who handle food security in the past two years.

3. What is the most important thing your company can do to secure the food you handle from intentional contamination?

4. What metrics do you use to monitor effectiveness of security measures?

1. To receive reports of the analysis of this survey and/or

2. To receive a copy of the benchmarking tool that will be prepared for your use

please email (jkinsey@umn.edu) or call The Food Industry Center at 612-625-7019.

Leave your name and mailing address, email and telephone number. Request items 1 and/or 2 above.

Glossary

Company/ firm/ co-op – These terms can be used interchangeably throughout the survey. They refer to an individual organization. Note: questions relating to the firm refer to actions taken independently as opposed to those done in conjunction with a firm's trading partners or supply chain.

Food Safety and Inspection Service, USDA -- The Food Safety and Inspection Service (FSIS) is the public health agency in the U.S. Department of Agriculture responsible for ensuring that the nation's commercial supply of meat, poultry, and egg products is safe, wholesome, and correctly labeled and packaged.

Reward – Rewards can be either monetary, a financial reward, or "recognition," recognizing employee actions.

Security measures – Specific steps taken to prevent tampering with food products beyond traditional theft.

Security metrics – Standards developed to measure or quantify success in meeting security programs, protocols, or specifications.

Supply Chain -- The processes designed to create value by efficiently integrating relevant activities, within and between trading partners, in order to minimize the system-wide costs of moving product from raw material to consumption and satisfying the service requirements of the market. Note: questions relating to the supply chain refer to actions taken in response to demands placed on an organization, or developed, by its outside trading partners.

Supply Chain security metrics -- Standards developed to measure or quantify success in meeting security programs, protocols, or specifications established by, or in response to "supply chain," as opposed to an individual company's requirements.

Supply Chain security procedures -- Specific steps taken to prevent tampering with food products beyond traditional theft established by, or in response to "supply chain," as opposed to an individual company's requirements.

Timely – The time required to identify the lot numbers of product deemed to be questionable and to begin notifying others in the supply chain – assumed to be three hours or less.

Valid – Accurate or correct information – assumed to be at least 97% correct.

Appendix II

Michigan State University Competencies

The following sections offer more detail regarding each competency.

Process Strategy (PS)

Executive commitment to defense and fostering a defensive culture is a necessary condition for implementing an effective security and defense environment. Top management needs to encourage frank discussions regarding the importance of defense, both for the safety of stakeholders and in maintaining the value of the firm's brand. Top management must be visible in their commitment and dedication to implementing defense initiatives and some firms have created a "chief security officer" position or a security management team to provide additional structure and visibility to defense and security initiatives. Additionally, through training and sharing of threat information, executives foster a culture among personnel that places defense and security among their top priorities.

Process Management (PM)

Process management describes the procedures and actions taken to ensure the security and defense of each activity involved with the purchase, manufacturing, and logistics of raw materials into a facility and finished product out of a facility. Process management includes the use of simulated incidents to test the integrity of procedures and processes. It also encapsulates the formalized disaster management process and evaluates the degree to which the firm has put planning, detection, response, and recovery procedures into place. Simulated incidents may include table-top exercises designed to test the effectiveness of a firm's security capabilities.

As the name implies, process management also involves the in-depth knowledge, and management, of firm processes. This is necessary to identify vulnerabilities that may be exploited by discontented employees or terrorists. Additionally, firms that increase their process knowledge may discover redundant, or unneeded, activities. Discontinuing these activities could reduce firm overhead and process variability leading to lower costs and improved service levels. This is one avenue through which firms may find synergies in security that allow for operational improvement as well as an increase in security competency.

Infrastructure Management (IM)

Infrastructure management addresses the manner in which a firm secures and defends its physical premises and products. This includes employee/non-employee access control into facilities (or areas within facilities), employee background checks, securing empty and loaded trailers before/during transport, and guards, among other measures. These are the most basic, and commonly thought of, steps to increase security and defend the perimeter that guards against unauthorized entry into a given space.

Communication Management (CM)

Firms need to develop strategies for sharing potential threat and security information internally with employees and providing communication channels for employees to use when a potential threat exists or incident occurs. Firms need to develop threat awareness and security training programs. Similarly, the working environment may need to be changed to acknowledge unknown personnel in a facility. In this sense, communication management is related to process strategy. Communication management tools are used to implement a security and defense culture.

Communication management may also simultaneously increase security and operational performance. This occurs if security and defense related communication requirements increase interdepartmental contact and break down "silos". For example, if the purchasing and manufacturing functions have not previously communicated until they begin sharing security related information, it is possible that they could begin sharing non-security related information (e.g. ways to schedule receipts of purchased materials to match the production schedule), which could improve firm performance.

Management Technology (MT)

Management technology is applied to detect a potential security and defense threats or incidents, and share timely and reliable information internally and externally. Information systems provide a first defense mechanism by which to understand trends in product contamination, missing shipments, and the root causes of these occurrences. These information systems also play a critical role in gathering information that is subsequently shared with suppliers, customers, 3rd party service providers, and government agencies to identify potential problems or recovery actions at the intersection between firms.

Process Technology (PT)

Process technology involves the presence, use, and ability of information systems to track the movement of products and monitor processes internally and across the supply chain. Process technologies include the use of tracking technologies, such as radio frequency identification (RFID) and smart-seals, and process improvements.

Many firms have not progressed beyond implementation of physical security measures (e.g., gates, guards, and cameras) and have not garnered the advantages that may come from tracking technologies. These advantages represent another avenue through which security may "pay for itself." Previous work has found that equipping containers with smart-seals, electronic seals that track the movement of supply chain assets through global positioning systems (GPS) and/or RFID, effectively reduced administrative overhead, improved labor productivity, lowered transaction costs, reduced theft, and induced savings in safety stock and overall supply chain inventory. Process technology is one avenue to explore to derive synergistic benefits from security.

Metrics and Measurement (MM)

Security metrics and measurement involves the continuous development, use, testing and redefinition of guidelines measuring security related procedures, plans, and capabilities. Metrics might be implemented to comply with specific guidelines, such as those of a customer or government agency, or the firm may develop specific guidelines for which metrics are captured and evaluated. Similarly, firms may conduct audits or require external certification that current procedures and processes are in place to increase security and defense.

Relationship Management (RM) and Service Provider Management (SPM)

These competencies are critical to the discussion of supply chain security and defense as any supply chain protection program is only as strong as its weakest link. Collaboration with external entities (customers/suppliers and separately, service providers) is necessary to ensure that security procedures are communicated and followed. Global relationships present added security difficulties as the focal firms are unable to monitor their partner and protect against theft, contamination, or insertion of unauthorized counterfeit cargo.

These competencies may represent another means by which firms may uncover operational synergies through increasing security. Communicating security related information with supply chain partners and service providers may help firms to form closer bonds with these

entities and encourage collaboration on other, non-security related issues (e.g., sharing demand figures or promotional information).

Public Interface Management (PIM)

Public interface management describes the security related relationships and exchanges of information with the government and the public. Forging relationships with U.S. government agencies is a critical corporate capability to more fully defend the firm against terrorist acts. Firms may actively guide and participate in the development of government standards or security initiatives. Similarly, firms should develop well-defined processes for systematically monitoring and synthesizing information coming from public entities regarding possible treats while at the same time developing processes to communicate with appropriate government officials and the public should an incident occur.

Appendix III: Questions that Make Up Each of the Operational Defense Competencies

Practices

Physical Security

Q 1: Our firm has established access control for *employees* to ensure the integrity of facilities and operations;
Q 2: Our firm has established access control for *non-employees* to ensure the integrity of facilities and operations;
Q 48: Our *loaded* trailers and containers are stored in a secure environment;
Q 61: Our *firm's* transportation assets are *sealed* while in transit;

Audits and Metrics

Use for Questions 18 through 21:
Our firm's supply chain security metrics were developed based on _____ guidelines:
Q 18: Government;
Q 19: Industry;
Q 20: Internal;
Q 21: Key supply chain partner;

Q 33: Our firm regularly conducts security audits to determine weaknesses in physical security;
Q 65: Our firm regularly assesses the qualifications and credentials of security personnel;

Strategy/Security Protocols

Q 82: Our firm has processes in place to recover from a contamination/security event in our supply chain.
Use for Questions 85 through 89:
Our firm's continuity plans consider the potential lack of availability of _____ in the event of a crisis:
Q 85: Power/Electricity;
Q 86: Transportation;
Q 87: Water;
Q 88: Communications;
Q 89: Internet.

People

Communication

Q 26: Our firm has established a communication strategy for providing information about contamination/security incidents to the appropriate *government/public agencies*;
Q 27: Our firm has established a communication strategy for providing information about contamination/security incidents to the *media/public*;
Q 28: Our firm has established a communication strategy for providing information about contamination/security incidents to our *supply chain partners*;
Q 71: Our firm has defined *external* reporting protocols for contamination/security incidents.

Training
Q 8: Our firm has specific education programs for our supply chain partners regarding supply chain security procedures;
Q 29: Our firm participated in food security preparations with external public health groups (e.g. U.S. Public Health Service, Center for Disease Control);
Q 44: Our firm participates in emergency-preparedness planning with appropriate government agencies;
Q 58: Our firm has established consequences for employees who fail to comply with internal security procedures;

Supply Chain Partners

Supply Chain Collaboration
Q 50: Our firm's information systems provide our supply chain partners with the *timely* information they need to respond to contamination/security incidents;
Q 51: Our firm's information systems provide our supply chain partners with *valid* information they need to respond to contamination/security incidents;
Q 53: Our firm maintains a database containing emergency contact information for all of our suppliers and transporters;
Q 76: Our firm only uses suppliers and transporters with whom we have an established relationship.

Supply Chain Verification
Q 17: Our firm has defined consequences for supply chain partners who fail to comply with supply chain security procedures;
Q 74: Our firm uses security assessments to determine if relationships should be maintained with *suppliers*;
Q 75: Our firm uses security assessments to determine if relationships should be maintained with *customers*;
Q 91: Our firm audits the security procedures of *contract manufacturers*;
Q 92: Our firm audits security procedures of *frequently used suppliers* (e.g. employee/driver background checks, origination and ownership, ingredients, and packaging procedures);
Q 93: Our firm audits security procedures of *infrequently used suppliers* (e.g. employee/driver background checks, origination and ownership, ingredients, and packaging procedures);
Q 94: Our firm audits the security procedures of *our customers* (e.g. employee/driver background checks, origination and ownership, ingredients, and packaging procedures).

Food Products

Tracking/Monitoring
Q 31: Our firm has defined procedures to complete product recalls;
Use for Questions 38 through 43
Our firm's information systems allow us to provide any and all of the following information within 24 hours, if requested by the FDA, for each food item transported within the past year:
Q 38: The name of the immediate previous source and immediate subsequent recipient;
Q 39: The origin and destination points;
Q 40: The date the shipment was received and released;
Q 41: Number of packages in the shipment;

Q 42: Description of freight;
Q 43: Route of movement and transfer points through which the shipment moved.
Q 64: Our firm utilized the Hazard Analysis and Critical Control Point (HACCP) system.