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Editorial

Insights on the Special Issue on Product Safety and Security in the Global Supply Chain

A number of high profile recalls of food, medical products, and consumer products have focused public awareness and media attention on the safety of the products that we use and consume. Increasingly, many safety problems can be traced to vulnerabilities or disruptions that occurred within the supply chain, especially when the various product “touch points” occur in different countries or geographical regions. The purpose of this special issue is to focus on the special role that operations management can play in providing theories, frameworks and enhanced guidance in helping practitioners address the safety and risk management issues that arise as the product moves from supplier to customers. In the special issue, we include one essay and four papers that empirically address the effects of: (1) supply chain design; (2) offshore manufacturing; (3) safety leadership; and (4) time-based recall strategies in the management of safety and security in the food, pharmaceutical, and toy industries as well as in warehousing.

1. Editorial Essay: Product Safety and Security in the Global Supply Chain: Issues, Challenges and Research Opportunities

A number of high profile product safety incidents and recalls have heightened public attention to product safety and security. In this editorial essay, Maruchek, Greis, Mena and Cai discuss the role of the global supply chain in creating and exacerbating product safety and security risks that arise in five highly regulated industries: food, pharmaceuticals, medical devices, consumer products and automotive. In their discussion they emphasize that in each industry, the supply chain is becoming longer and more complex. While the outsourcing of manufacturing capacity has been increasing for the past decade, increasingly design capacity is being outsourced as well, leading to increased vulnerabilities and safety risks throughout the value chain. The special challenges in these industries, including contamination, counterfeit products, safety in the face of technological change, and integrating safety into design. All emphasize the need for researchers to explicitly consider product safety at the interfaces between operations management and supply chain design, new product development, and design engineering.

Four areas where operations management can provide new perspectives and relevant theories in the management of product safety and security risks are identified. The first is the area of regulation and standards where operations can collaborate with governments, industry associations, and other stakeholders in developing the proper incentives and effective control method-

ologies to prevent unsafe products from entering the supply chain. The second area is product lifecycle management. While already an established area of operations management, there has been very little recognition of safety and security as a lifecycle problem. Systematic processes adapted from total quality management and “smart” technologies can help manage the information to identify the root causes of safety problems throughout the product life cycle. We extend traceability to the supply chain and discuss how inventory tracking technologies may be used to address critical security problems that may arise. In managing product recalls, two emerging areas that seem quite promising are well-known in the operations management literature, information sharing between different stakeholders and organizational learning. Finally, supplier relationships can play an important role in addressing safety and security problems in the supply chain. Risk-adjusted models for sourcing, supplier selection, and supplier training and development are needed.

2. Global Supply Chain Design Considerations: Mitigating Product Safety and Security Risks

Over the past decade, researchers have consistently mentioned the complex design of global supply chains as a contributor to the vulnerabilities and disruptions that create safety problems in a number of industries. In the paper “Global Supply Chain Design Considerations: Mitigating Product Safety and Security Risks,” Speier, Whipple, Closs and Voss examine the risks associated with maintaining product safety in global supply chains and highlight particularly salient security initiatives that can mitigate these risks. The paper develops a multi-disciplinary framework by integrating three different perspectives: normal accident theory, high reliability theory and situational crime prevention, in order to more fully understand the breadth of risks that firms in global supply chains should attend to. Speier et al. use a multi-method approach in their research. The first phase is a grounded theory approach whereby executives and managers in the food, pharmaceutical and hazardous materials industries are interviewed to identify key themes in their firms’ overall safety and security initiatives.

From this qualitative data, the authors identify four overall themes that consistently underlie the security efforts of many firms. These themes include process management, information sharing, supply chain partner security management, and service provider security management. The second phase in the research is a quantitative survey of the executives in the food industry to determine the conditions under which each security initiative is

best suited. Results from the study demonstrate the importance of top management mindfulness associated with product safety as a critical driver of investments in security initiatives, including improved process management and information sharing, and more focused efforts in supply chain partner and service provider management. Similarly, the findings from this research highlight that firms with greater supply chain complexity, particularly those that manufacture or transport products with greater inherent risk, also make greater investments in security initiatives. Finally, firms with tighter coupling amongst supply chain partners, as a means to improve product quality/speed of delivery, will invest in supply chain partner and service provider management initiatives to mitigate security risks.

3. Quality Risk in Offshore Manufacturing

As businesses increasingly outsource their manufacturing capacity to offshore facilities with lower costs, questions arise as to whether these offshore locations can and will maintain the same level of quality as mainland locations. In “Quality Risk in Offshore Manufacturing: Evidence from the Pharmaceutical Industry,” Gray, Roth, and Leiblein address the question of whether the location of a manufacturing site affects quality risk. Quality risk is defined as the propensity of a manufacturing establishment to comply with good manufacturing practices. Compliance with “Good Manufacturing Practices” (GMP) is a requirement for FDA market approval in several industries, including food, drugs and medical devices. Using inspection data obtained from the Food and Drug Administration (FDA), Gray et al. employ a Delphi process to develop a plant-level quality risk score that is used to compare regulated drug manufacturing plants in the U.S. mainland with those Puerto Rico. Using a sample of 30 matched pairs of regulated pharmaceutical plants in the U.S. and Puerto Rico, the authors use regression models to test their hypotheses that (1) the educational level of the local population, (2) the concentration of similar plants in the locality, (3) geographic distance between the plant and headquarters, and (4) the cultural difference between the home country and the offshore plant will each affect the quality risk of a plant.

The results demonstrate that, on average, established Puerto Rican plants operate with a significantly higher quality risk than matching plants operated by the same firm located in the U.S. mainland. This finding proves to be robust even after the inclusion of numerous product, firm and political control variables. The significance of cultural distance in explaining differences in quality risk suggests that firms may face challenges in transferring knowledge regarding quality management practices from domestic to offshore plants. The findings accentuate a heightened need to incorporate quality monitoring costs into offshore plant location decision models and the importance of continually assessing the quality processes of non-domestic plants.

4. Accidents Happen: The Influence of Leadership, Safety Consciousness and Hazard Reducing Systems on Warehouse Accidents

Accidents that occur in the workplace can help to identify unsafe conditions that could possibly compromise the quality or safety of products that are being processed, handled or stored in that same environment. There is a growing sentiment that workplace safety goes hand in hand with higher product quality and better manufacturing practices. In “Accidents Happen: The Influence of Safety-Specific Transformational Leadership, Safety Consciousness and Hazard Reducing Systems on Warehouse Accident,” de Koster, Stam and Balk investigate the antecedents of safety performance in warehousing. Operational safety is a critical issue for most ware-

houses since the costs of accidents are substantial, not only in direct productivity loss, but also in consequential damages. Using behavioral operations management, organizational behavior and safety management, the authors identify hazard reducing systems (HRS), safety-specific transformational leadership (SSTL), and safety consciousness (SC) as potential predictors of safety performance, which is measured by a weighted average of the number of accidents per full-time equivalent (FTE).

Path analysis on data collected from a survey of 78 warehouse managers and 1033 warehouse employees demonstrates, consistent with prior research, that HRS is a strong predictor of safety performance. (The HRS construct consists of four factors: safe traffic measures, training, hygiene and safe storage). Importantly, the results also suggest that SSTL may be an even more important predictor of safety performance than HRS. An SSTL score is computed for each manager using a scale that measures the ability of that manager to influence, motivate, intellectually stimulate and engage employees in ensuring safety in the workplace. SSTL affects safety performance directly and strongly predicts safety performance even after controlling for the effects of HRS. SSTL also mediates some of the effects of HRS on safety performance. Surprisingly, SC defined as the employee’s own awareness of safety issues does not mediate the relationship between SSTL and safety performance. de Koster et al. conclude that leadership is critical in fostering safety on the work floor. To the extent that the results can be extrapolated, they suggest that leadership is critical in assuring that employees adhere to rules and regulations relating to product safety and security.

5. Safety Hazard and Time to Recall

As product recalls continue to increase, stakeholders are gradually recognizing that recalls are an inevitable, but costly, part of conducting business. In “Safety Hazard and Time to Recall: The Role of Recall Strategy, Product Defect Type, and Supply Chain Player in the U.S. Toy Industry”, Hora, Bapuji and Roth note that stakeholders are not only concerned about the cost of a recall, they are also raising questions about the speed of a recall. Accordingly, these researchers shift attention from why products are recalled to why it takes so long to recall a defective product that poses a potential safety hazard. Hora et al. empirically examine the *time to recall*, which is measured as the difference between the product recall announcement date and the product first sold date, and its relationship with recall strategies, source of the defect and supply chain position of the recalling firm. Using a sample of 528 product recalls in the toy industry as reported by the Consumer Product Safety Commission (CPSC) over a fifteen year period from 1993 to 2008, the researchers use regression models to determine the significant factors in the time to recall. The results show that a preventive recall strategy, where a voluntary recall is announced before an injury has actually been reported, is associated with a longer time to recall than a reactive strategy, where the recall is announced only after an injury is reported. The source of the defect is also an important factor with design flaws associated with a longer time to recall than manufacturing flaws. Finally, the supply chain position of the entity that makes the recall influences the time to recall. Recalls issued by distributors and toy companies are characterized by a longer time to recall than those issued by retailers.

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