
Managing Supply Chain Disruptions

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Dedication

Dedicated to my son Rohan Vakharia whose passion for learning and desire for excellence was an inspiration to all those who knew him.

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Managing Supply Chain Disruptions

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Abstract

Given the substantive negative financial, marketing, and operations-related consequences of supply chain disruptions, it is not surprising that most organizations are expending significant efforts to develop effective disruption management strategies. Further, the focus on low-cost (and lean) supply chains to control costs has also resulted in magnifying the impact of even a small disruption at any stage of the chain. Thus supply chain managers are constantly evaluating and trading-off the low costs of a lean supply chain with the benefits of a highly responsive (and potentially higher cost) supply chain. In this monograph, the authors provide a comprehensive review of the current research and practice related to managing supply chain disruptions. In essence, the focus is to structure and describe these extant contributions with a view to identify directions for future research.

Contents

| | | |
|----------|--|-----------|
| 1 | Introduction | 1 |
| 2 | Supply Chain (SC) Disruptions | 7 |
| 3 | Disruption Risk Management | 13 |
| 4 | Conceptual/Empirical Research | 23 |
| 5 | Robust SC Design Research | 29 |
| 6 | Research on Specific Disruption Risks | 43 |
| 6.1 | Product Uncertainties | 43 |
| 6.2 | Supply Uncertainties | 49 |
| 6.3 | Operations/Process Uncertainties | 59 |
| 6.4 | Transportation Uncertainties | 61 |
| 6.5 | Additional Research | 64 |
| 7 | Directions for Future Research | 71 |
| A | Appendix | 77 |
| | References | 83 |

1

Introduction

Consider the following recent occurrence:

The recent (January 2009) recall of peanut butter made by Peanut Corp. of America underscores the inherent difficulties large food companies have in monitoring their supply chains. Though analysts say product recalls have only a measured financial impact on food makers in the short term, greater costs are inherited in the long term as consumers question the safety of their products. According to Pat Conroy, national consumer products leader at Deloitte LLP, “the soft costs are with respect to [product] brand, which is ever more important as consumers have the ability to differentiate [between] products more than they used to.” Although companies with large product portfolios, like Kellogg and General Mills, are less likely to suffer from the financial impact of product recalls as they are generally viewed as safe and trustworthy by the wider public, consumers are becoming less tolerant of food recalls, and are taking greater

2 *Introduction*

initiative to ensure that the products they purchase are indeed safe. Conroy recommends that companies put more effort into policing not only direct suppliers, but also those in their suppliers' supply chains, and educating consumers about the methods they use to ensure product safety.¹

This example is one of many that highlights the fact that there are substantial short- and longer-term effects stemming from supply chain disruptions. In addition, several recent observations/developments have also led to an increased focus on supply chain disruption management. First, supply chain managers are starting to recognize that business continuity planning mechanisms are not enough to mitigate the impact of supply chain disruptions on their operations as documented by responses to disasters such as the terrorist attacks on 9-11, the devastation of New Orleans after hurricane Katrina, and the tsunami in Thailand and India. Second, there are several studies which document that disruptions in the supply chain can lead to a substantive negative financial impact on firm and industry performance. Third, the potential negative regulatory and consumer ramifications of supply disruptions of consumer goods, such as toys and food products, are leading firms to recognize the significant non-financial impact of disruptions in supply channels. Fourth, the move toward a lean supply chain to obtain supply chain efficiencies has resulted in a loss of "slack" capacity and more interdependent links within the chain. Thus, it is likely that even a small "glitch" at one stage in the chain could result in a significantly larger effect downstream and/or upstream much like the bullwhip effect. Finally, the emergence of globalization as a competitive strategy has also led to an increase in the types of risks inherent in supply chains which span multiple countries.

From a supply chain perspective, disruptions can lead to severe consequences. For example, Hendricks and Singhal [18, 19, 20] report that companies experiencing disruptions in the supply chain can typically expect declines in sales growth, stock returns, and company value. On a

¹<http://www.smartmoney.com/news/on/?story=ON-20090120-000599-1451&print=1>.

global level, there are also reports of Australian firms which face similar consequences due to disruptions in the supply chain²; MG Rover in the UK which was forced to suspend plant operations due to parts shortages and soon thereafter the company ceased to exist. Other examples of major disruptions in the last decade include:

- In 2001, the attack on the World Trade Center led to significant regulatory changes in the process by which goods could be shipped in and out of the United States. In the short run, retail companies such as JC Penney, which relied on shipping products on a “just-in-time” basis, experienced significant short-term lost sales due to product unavailability.³
- In 2002, the longshoremen strike at the LA docks significantly impacted the availability of retail products which were manufactured in the Far East and sold in the United States.⁴
- In 2004, a flu vaccine manufacturer in the UK encountered contamination in its processes and this led to a shortage of the flu vaccines available to consumers in the 2004–2005 flu season.⁵
- In 2007, the recall of Mattel toys (primarily toy cars) manufactured in China due to the toxic contents of the paint resulted in significant lost sales for the company.⁶

From an individual firm or company perspective, disruptions due to natural causes (such as earthquakes, floods, hurricanes, and tsunamis) are not an entirely new phenomenon. In fact, “Business Continuity Planning” (BCP) has its foundations in the effective management of the consequences of disruptions due to natural causes. For example, companies that operate customer service call-centers in Jacksonville, Florida recognize that hurricanes can completely disrupt their operations.

² www.gartner.com/press_release/asset_148797_11.html.

³ A presentation made at the Center for Retailing Education and Research, University of Florida by Jim LaBounty, VP of Supply Chain Management, JC Penney, October 12, 2006.

⁴ <http://scm.ncsu.edu/public/risk/risk7.html>.

⁵ <http://www.logisticstoday.com/displayStory.asp?S=1&sNO=7792&MLC=SC..>

⁶ <http://www.theferrari.com/blog1/?cat5>.

4 *Introduction*

Hence, their continuity plans include at a minimum: (a) a technology (hardware and software) backup at alternative locations; and (b) plans to physically move their employees to the alternative locations. In more recent years, BCP has expanded to focus on other types of supply chain risks (i.e., those which are not always a consequence of natural causes). Perhaps the single most critical factor driving this is the fact in the increasing dependence on suppliers has led to supply chains to become more and more lean and in these settings the impact of disruptions is more significant. As with any organization wide initiative, key elements and principles for implementing BCP are top management commitment, processes to ensure continuity of responses, risk assessment mechanisms, and speed and responsiveness indicators/measures. Zsidsin [53] also presents case study evidence of how a firm managed the impact of disruptions stemming from hurricanes Katrina and Rita. This firm used liquid hydrogen as a key energy source for manufacturing its products and due to this natural disaster faced a severe quantity shortage. A combination of risk assessments, business interruption plans, and inventory management policies enabled the firm to reallocate existing stocks of liquid hydrogen from its R&D facilities to its manufacturing plants, and simultaneously develop alternative energy sources for continuing its R&D activities.

A more proactive approach to managing disruptions is the risk management framework adopted by Ericsson to manage supply chain disruptions after the company's operations were significantly impacted by a fire at a supplier facility in Albuquerque (Norrman and Jansson [30]). The focus adopted by the company was to minimize the risk exposure in the supply chain on the basis of a process with feedback loops between the sub-processes. In essence, a four-stage process was adopted: Risk identification — mapping of the upstream supply chain to identify critical aspects, sources of risk, and the likelihood of their occurrence; Risk assessment — analyze each risk source to obtain a perspective on how to avoid business interruptions due to the risk; Risk treatment — development of alternative risk mitigation strategies with corresponding costs and their potential to address specific risks; and Risk monitoring — focuses on analyzing the process by which specific risks and developing standardized templates to handle similar risks.

In addition to this four-stage analysis, the company also evaluates the adoption of each risk management strategy by trading-off the costs of a strategy versus the potential benefits of reduced business recovery time.

The recent trends and developments within supply chains, such as increased use of outsourcing of manufacturing and R&D to suppliers, reduction of supplier base, reduced inventory and lead time buffers, shorter product life cycles, have created long, lean, and interconnected chains of companies which are vulnerable to disruptions and their potentially devastating ripple effects. Further, the integrated nature of these supply chains indicates that it is not possible to manage disruption risks by focusing on a single stage. Instead disruption strategies should be developed and implemented such that they mitigate risks across the entire chain. Industry efforts to combat disruptions have been to either adapt traditional thinking (a la BCP) or formulate company-specific strategies (à la Ericsson) as discussed above.

In this monograph we categorize and review the substantive research contributions relating to managing SC disruptions. Since our primary focus is on formulating directions for future research, we do not offer a comprehensive review but instead focus on significant research and practical findings which enable us to do so. The remainder of this monograph is organized as follows. In the next section, we review the general area of SC disruptions and examine classifications of disruptions which can be used to provide insights into the disruption management process. In Section 3, we review the literature in the emerging field of disruption risk management which attempts to identify specific risks associated with SC disruptions. This is followed, in Section 4, by a review of conceptual/empirical research with a focus on providing general insights into how one or more organizations have managed the risk associated with disruptions. Given that designing robust SC networks are a key feature of managing disruption risk, we review the relevant research in this domain in Section 5. A detailed analysis of prior research targeted at managing specific risks (e.g., product, supply, operations/process, and transportation risks) is presented in Section 6, and finally, directions for future research are discussed in Section 7.

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