

# Chapter 11

## Disruption in Supply Chain

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### ABSTRACT

*Recent trends in the global business environment such as overwhelming globalization, short product life cycle, and cost reducing strategies have exposed various types of supply chains in the face of a great deal of uncertainties and risks. One of the main risks in supply chain is risk of disruption. Disruptions, which can derive from natural and man-made sources, have attracted the attention of academia, industry, as well as supply chain advisors. The importance of the topic becomes more vital when it is observed that prior planning for the disruption can significantly reduce the adverse consequences of disruption. Therefore, in the chapter, the authors would try to introduce the phenomenon of supply chain disruption along with its importance. Recent trends that greatly necessitate careful planning of supply chain disruption are presented, and lastly, different ways through which the adverse consequences of disruption can be mitigated are given to the readers.*

### 1. INTRODUCTION

“Ericsson lost 400 million Euros after their supplier’s semiconductor plant in New Mexico caught fire in 2000; Land Rover laid-off 1,400 workers after one of their key suppliers became insolvent in 2001; Dole’s revenue declined after their banana plantations in Central America were destroyed by Hurricane Mitch in 1998; and Ford closed five

plants for several days after all air traffic was suspended after September 11 in 2001.” (Tomlin, 2006) all and all of this prompt the researchers to work on the subject of managing supply chain disruptions.

We are living in an uncertain world. There are many examples of disruptions that have caused huge amount of loss to the firms which were not prepared to deal with them while those who already had planned for these situations could capture huge benefits. “Historical data indicate

DOI: 10.4018/978-1-61350-504-5.ch011

that the total number of natural and man-made disasters has risen dramatically over the last 10 years” (Tomlin, 2006). For example, in 2001, there was a disruption, fire, in one of the Philips semiconductor plants which damaged a great number of chips. Ericson Corp., which was one of the major customers of the plant, incurred high losses while its rival, Nokia Corp., could better tackle the crisis by switching his orders to some other suppliers. In fact, the multi-supplier strategy of Nokia saved him from the same disaster that Ericson could not escape from. Such kind of costly events have prompted a great number of researchers and practitioners to study and plan for the existing and potential disruption risks involved in the supply chains and make the firm prepared enough to deal with such crisis.

In this chapter, we shed light on the disruption on supply chain. In the next section we try to define the disruption and how it is related to the general concept of risk. Section 3 explains why even the disruption in supply chain is important and should be studied. Section 4 tries to describe recent practices drive the topic of supply chain disruption to become even more challenging and the underlying factors for analyzing each cause is presented. Also, section 5 discusses different ways through which we can manage and reduce the effect of disruptions in supply chain.

## **2. SUPPLY CHAIN DISRUPTION**

Supply chains are exposed to different types of risks among which disruption is a particular type. Wagner and Bode (2006) have a discussion about the meaning of risk. Risk can have two aspects: negative aspects and positive aspects or in other words, danger and opportunity (Mitchell, 1995). As far as this chapter is about the disruptions, which are destructive, the same approach to risk (as Wagner and Bode (2006), in which risk is considered to be negative) is considered. According to the definition of Juttner et al (2003), sup-

ply chain risk is “variation in the distribution of possible supply chain outcomes, their likelihood, and their subjective value”. Chopra and Sodhi (2004) classifies the risks of the supply chain as disruptions, delays, systems, forecast, intellectual property, procurement, receivables, inventory, and capacity. Knowing the relation between risk and disruption, here we define disruptions as “random events that cause a supplier or other elements of the supply chain to stop functioning, either completely or partially, for a (typically random) period of time.” Snyder et al. (2010) The authors of the recent paper by addressing different supply chain uncertainties as yield, capacity, lead-time and input cost uncertainty, point out that disruption is more like the yield uncertainty of the supply chain. The misunderstanding that supply chain disruptions are rare events has been described in Snyder et al. (2010) and referring to Wal-Mart emergency operations center, they explain that some kinds of disruptions may occur frequently.

Chen and Ji (2009) have classified the types of supply chain disruptions as follows: Supply disruption, demand disruption, transportation disruption, information disruption and production disruption. Supply disruption can occur in the case of natural disasters, strikes, and etc. Demand disruption is the time that customers are not willing to buy a product for any reason, so the product cannot be exchanged with money. Transportation disruptions happen when disruption occurs in the transportation and halt the transit of the goods from the production line to the consumers. Information disruption is when the information flows are disrupted or distorted. Production disruption is related to the production line and some disruptions which make problems in producing the products on time.

It is of great importance to know the subtle difference between risk and vulnerability. Vulnerability is a weak point that exists in the system and the risk is the probability of incurring loss from the existence of that. So, vulnerability can lead to different losses according to the environment that

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