Chapter 7
Modeling and Simulating Disruptions and other Crisis Events in Virtual Enterprise Networks

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ABSTRACT

Simulation is not only a powerful decision-making aid for supply chain managers but also a powerful research tool for theory building and testing. In addition to incorporating stochastic situations, simulation also enhances decision making by offering the flexibility to understand system behavior when cost parameters and policies are changed in a timely, cost-effective, and non-disruptive manner. The purpose of this chapter is to illustrate an approach toward modeling disruptions, risks and other crisis events in virtual enterprise networks. It provides several illustrations from published literature, presents a framework for managers and researchers to better apply and gain from the strength of simulation modeling, identifies several common pitfalls to avoid during the process, and compiles extensive references for readers who want to further their knowledge in this specific area.

INTRODUCTION

The focus of managing business organizations has been shifting from enterprises with well-defined structures, limited external relationships, and a focus on internal optimization to enterprises that are interconnected with each other in a network, have tightly integrated yet dynamic relationships with their suppliers and customers, and pursue overall network optimization. In today’s day and age, these networks are no longer rigid combinations of enterprises; they are fluid structures comprising independent institutions, businesses, and specialized individuals. These member entities of a network collaborate with each other using information and communication technology to gain competitive edge and to create value for the end customer. Yet the membership of a network is not constant. Member entities join and leave as and when their product and/or service offerings are required. The composition of these networks is dynamic, changes continually and forever seeks the next level of optimization.
both in terms of efficiency and value creation for the end customer. The means of collaboration are information and communication technology intensive and the networks span the entire globe. In effect, networks have transformed into global Virtual Enterprise Network (VEN) systems.

A virtual enterprise network may be defined as a temporary alliance of distributed independent enterprises that participates in the different phases of the life cycle of a product or service, and work to share resources, skills, and costs, supported by information and communication technologies, in order to take advantage of market opportunities (Ahuja & Carley, 1998). They are formed when new products are introduced and are dismantled when products are obsolete (Grefen et al., 2009). Typically, there may be a leading or a focal firm that is instrumental in guiding the structure of a virtual enterprise network. In sum, these virtual enterprise networks have dynamic and agile configurations.

These networks are attractive because they provide access to skilled manpower, low-cost labor and raw materials, better financing opportunities, larger product markets, superior technology, arbitrage opportunities to hedge or take advantage of events such as currency fluctuations, and additional inducements offered by host governments to attract foreign capital such as tax incentives. However, tied with these benefits are risks and disruptions related to currency, transit times, quality, safety, culture, opportunism, inventory ownership, intellectual property and several others. Some of the most severe disruptions can even jeopardize a company’s survival. These include events such as supplier bankruptcy, production shut-down upstream or downstream the network, port strikes, wars, natural disasters and several others. It is critical to understand the impact of such disruptions on a network to ensure business continuity for all network members. Disruption at one entity in a network may put the entire network at the risk of a shut-down. Additionally, disruptions also negatively impact the stock-value of companies (Hendricks & Singhal, 2005).

In a global virtual enterprise network, any decision is complex to arrive at, expensive to implement, and may need continual alterations as the network evolves, priorities are realigned, and environment changes. In such situations, it is difficult to assess the cost of risks in any decision and an incorrect choice can lead to expensive mistakes with sometimes disastrous consequences. For such situations, it is important to have good crises management plans (Kleindorfer & Saad, 2005). However, even better and of fundamental importance is linking risk assessment and quantification with risk management options ex ante. It is critical to understand the potential risks and disruptions and the extent of ultimate harm to the virtual enterprise network. In an absence of pro-active risk management, there might be a feeling of apprehension and an impression of unpreparedness and uncertainty in the firm and the virtual enterprise network. This will result in actions that are not necessarily directed towards the most effective strategies for managing risks and planning for disruptions. Rather, they are developed based on some short-term, myopic incentives. As one manager interviewed by the author said:

“...it’s not that they [supply chain managers] don’t want to (include risks in analyses). It’s not that they don’t know they should look at risk. But I think they don’t because of the pressures they’re under; the goals that they have to meet for the year. They probably figure, hey look, it’s a low probability, probably won’t happen and, frankly, my boss isn’t asking me to look at it. So, why should I be a hero and miss my objectives? It’s the right thing to do but they aren’t rewarded for doing it. Maybe that’s at the heart of this, is no one is compensated or incented in their day to day job to look at and evaluate the risks properly.”
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