

Chapter XXI

Supply Chain Risk Management: A Game Theoretic Analysis

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ABSTRACT

This chapter introduces a game-theoretic approach to supply chain risk management. The focus of this study lies on the risk of a single supply chain member defecting from common supply chain agreements, thereby jeopardizing the overall supply chain performance. The chapter goes on to introduce a manual supply chain game, by which dynamic supply chain mechanisms can be simulated and further analyzed using a game-theoretic model. With the help of the game-theoretic model, externalities are identified that negatively impact supply chain efficiency. The conclusion drawn

from this chapter is that incentives are necessary to overcome these externalities in order to align supply chain objectives. The authors show that the game-theoretic model, in connection with the supply chain game presented, provides an informative basis for the future development of incentives by which supply chains can be aligned in order to reduce supply chain risks.

INTRODUCTION

In recent years, supply chain management (SCM) has experienced considerable attention. Trends,

such as lean management, have unleashed outsourcing with the aim of improving corporate efficiency, which, in turn, considerably reduced the vertical range of production. The result is that original equipment manufacturers (OEMs) have outsourced as much as 80% of their value chain. This resulted in an increasing dependency of companies on their suppliers. Intricate supply networks evolved, shifting competition from the single company level to the supply chain level. Thereby, supply chain management became an asset when it comes to guaranteeing efficiency and high service levels (Christopher, 2004).

As a consequence of the interorganizational dependencies, supply chain competition fosters risks. These dependencies and the rising complexity of supply chain networks have increased the importance of supply chain risk management. Although connectivity between the players and transparency across the supply chain are core aspects propagated by SCM in contemporary literature, reality shows that insufficient communication among supply chain participants still prevails. Therefore, interorganizational risks have the potential to become one of the core fields of supply chain risk management (SCRM) research in future.

As supply chain participants are always (potential) competitors, the intensity of collaborative efforts are always a matter of how high single organizations prioritize supply chain alignment. Incentives are a way to overcome the barriers keeping organizations from aligning their objectives. Finding the right incentives for SCRM can turn out to be an extremely hazardous and difficult task for supply chain risk managers. One option is to create mathematical models based on economic settings. However, whether all variables have been considered is only validated the moment the incentive is tested in a realistic setting for a certain period of time. This realistic setting can either be simulated by means of an electronic simulation model, a manual business game, or on a real supply chain. Since it is difficult to analyze

the influence of a particular change within a supply chain—particularly due to the vast amount of interactions and the fact that such a change can also negatively influence a chain—the last option can be aborted. The first option does not include the variable that human beings make organizational and interorganizational decisions, which we considered to be central to SCRM. Therefore, we opted for the manual business game. Supply chain risks are evaluated in the so-called supply chain game. The supply chain risks analyzed here are specifically inventory risks, caused by interorganizational drivers. Bringing supply chain networks in connection with strategy and competition addresses a matrix of risk drivers within the locus of this level: horizontal and vertical competition and cooperation. Interorganizational aspects include “co-opetition,” a combination of cooperation and competition, as coined by Brandenburger and Nalebuff (1997). This chapter will focus on the vertical organizational and interorganizational risk drivers related to these aspects. To date, SCRM has largely focused on combating the impact of supply chain risks or improving the resilience of supply chains to be able to react to unfavorable changes taking place. Therefore, we can deduct that current SCRM is largely reactive.

Proactive SCRM would require that sources and drivers of supply chain risks are manipulated in a sense that they are, in the best case, avoided, reduced, or at least controlled. Incentives provide the opportunity to do so. However, although incentives have gained wider popularity since the birth of the balanced scorecard (Kaplan & Norton, 1996), they have not yet been implemented as proactive measures in SCRM, and the effects of specific incentives are unclear. In a first step to developing such a proactive incentive framework, it will be shown that the supply chain game enables an ideal test surrounding for testing implications of certain incentives on SCRM. It will be shown that the game correlates to supply chain and market conditions, which justifies it as a reference model.

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