



## **Chapter XIII**

# **Supply Chain Risk Management: A Game Theoretic Analysis**

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## **Abstract**

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*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

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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

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