

## Chapter 21

# The VESP Model: A Conceptual Model of Supply Chain Vulnerability

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### ABSTRACT

*During the last decade, researchers and practitioners became more interested in the domain of vulnerability analysis. It is considered as a key element in defining and managing supply chain risks. The great complexity of a global supply chain and of its environment, coupled with managerial trends, makes such a chain more vulnerable to disruptive events. A clear understanding of the possible consequences generated of this combination is a fundamental step to build an effective risk management plan and strategies. However, more studies are needed in order to develop the understanding of supply chain vulnerability. This article provides an explorative framework in order to analyze and quantify vulnerability within supply chains. Based on the existent literature, this article explores the factors that affect the level of Supply Chain Vulnerability (SCV). Four key components of SCV are identified (i.e. Exposure, Sensitivity, Susceptibility and Preparedness level). Based on these four categories of SCV, a conceptual model is developed. Such a model enables the definition of clear metrics and can further be used by researchers and practitioners to build consistent quantification methodologies.*

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## INTRODUCTION

The increasing complexity of the supply chain networks and the strong interdependencies existing between logistics organizations taking place in different business field make supply chains vulnerable to potential disruptions and risks. Environment changes and turbulence, which affect supply chains all over the world, is one of the most important factors influencing the efficiency of the supply networks by increasing the exposure level to risks. As a result, there is an increasing consciousness of the vital importance of developing risk management approaches and strategies across all actors within supply chain networks. According to BCI survey (2015), 74% of managers stress the need to manage supply chain risks. According to the same report, organizations face today more than 24 sources of risks, with different levels of impacts and consequences. The most common consequences of these risks are the loss of productivity (58%), customer complaints (40%) and increased cost of working (39%), with annual cumulative losses of at least €1 million per year due to supply chain disruptions (BCI, 2015).

Unfortunately, not all risks could be prevented or managed. This is why companies are striving for more secure, resilient and less vulnerable supply chains and their strategies become more oriented risk strategies (Liu et al., 2014). The urgent need to protect supply chains and to make them less vulnerable to different types of disruptions has been highlighted from both researchers and practitioners, where there is a common consensus about the need to understand the causing factors of Supply Chain Vulnerability (SCV) and susceptibility to risks. A company needs to know the current level and drivers within a supply chain to be able to deal proactively with risks and to ensure supply chain resilience. The identification and the evaluation of potential supply chain vulnerability can help companies within supply chain networks to enhance and to justify the security and resilience requirements to be applied to protect and secure their activities and their business (Wagner and Neshat, 2012).

However, it is of critical importance, only a small number of frameworks have been devoted to analyze and to quantify the effects of vulnerability on both supply chain and risk severity (Wagner and Neshat, 2012) and to identify its key elements. In light of the increasing need to investigate and to understand this domain, this paper presents some discussions and research perspectives enforcing the understanding of supply chain vulnerability. The different terminologies and definitions related to supply chain vulnerability and explored then we will discuss the results of identification of elements, drivers and assessment options founded in the literature review. We will then conclude by presenting the conceptual model of supply chain vulnerability developed to answer the needs predefined in the previous step, illustrating the argument, the conceptual background, the methodology used and the applicability of the developed model.

Following this, the body of this article is organized as follows: Section 2 illustrates the research methodology used in this paper. Section 3 provides the background of the study, drawing a brief summary of literature about vulnerability definitions and drivers. The definition of the model is presented and discussed in section 4. Section 5 provides the application of this model to a case study and analyzes the results. Section 6 presents the conclusion, limitations and future research directions.

## METHODOLOGY

Three methods are used to support this study: a literature review, conceptual modeling (Klag and Langley, 2013), and a case study research as a theory-building method. The literature review is performed in order to understand and to define supply chain vulnerability and also to identify its causing factors and

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