Incorporating the Predictability of Consequences into a Disruption Management Framework

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ABSTRACT

The authors introduce a disruption management framework that incorporates both the probability of disruption and the predictability of consequences. The resulting model prescribes one of four supply chain strategies: flexibility, risk and loss mitigation, agility, and resilience. Managers can leverage the presented framework within a comprehensive supply chain risk management process to develop tactics aligned with risk management, supply chain, and overall operating strategies to overcome a range of disruption consequences.

Keywords: Disruption Management, Risk Management, Supply Chain Risk Management

1. INTRODUCTION

Researchers recommend developing a risk management strategy that includes the consequences associated with supply chain disruption (Greenberg & Cramer, 1991). Yet, existing models focus primarily on the sources of supply chain (SC) threats. In this context, managers generally identify the source of a risk in the early stages of the risk management (RM) process, which allows them to categorize threats for further assessment. This approach fails to incorporate the consequences of SC disruptions into either the assessment and mitigation processes or even the broader organizational RM strategy. Hence, practitioners should consider not only the source of a disruption, but also the resulting consequences when evaluating SC risk.

We believe that when evaluating disruption risks based on the predictability of consequences, managers are better able to select appropriate mitigation tactics. For instance,
the Chinese New Year holiday is a predictable event known to disrupt many supply chains for a specified period of time. However, because of the nature of the holiday, managers can confidently select mitigation countermeasures, as they know how and when the consequences will manifest (i.e. the organization can reasonably estimate inventory shortages). Early shipments and temporary inventory buffers are logical and financially prudent. This strategy is preferred, as it will generally cost less to fund preventative countermeasures, rather than responding to the disruption consequences afterwards.

To contrast, a hurricane is unpredictable because it is difficult to articulate when a storm will appear or where it will actually make landfall. Specifically, a hurricane can manifest into a Katrina-type disaster (category-5), or alternatively a category-one storm, with little aftereffect. To evaluate, managers need to understand wind intensity, expected rainfall, and the inland storm surge, before assessing these risk sources. Yet, the consequences of different grades of hurricanes can be better calculated (i.e. insurance companies regularly predict the probability of loss for different hurricane scenarios).

There are also situations where disruption consequences overlap or stem from multiple sources of risk. For example, a production line may shut down due to a shortage of raw materials, a break in the electrical current, or a component within the line actually failing. In this case, vendor failure, a power outage, and component breakage are the sources of a risk, while the production line shutting down is the actual consequence. The consequence is predictable, because managers can reasonably determine the time between failures and the time associated with repair (e.g. mean-time-to-failure (MTTF) and mean-time-to-repair (MTTR)). With this knowledge, managers are able to identify specific countermeasures, such as inventory or redundant capacity, and minimize the impact of the downtime. In addition, by analyzing the consequences of disruption, managers are better able to utilize RM resources. Specifically, they can use one safeguard, rather than three, to mitigate the consequence of a SC disruption.

Existing RM frameworks emphasize risk identification, probability assessment, countermeasure evaluation, and countermeasure deployment (Knemeyer, Zinn & Eroglu. 2009). Researchers design these RM models to balance the probable losses of an identified threat with the financial costs of countermeasures. To compute potential losses, assessment algorithms multiply the probability of disruption by the loss estimates of a corresponding SC disruption. With this equation, the annual losses associated with frequent minor disruptions can theoretically equal the losses of a low probability/infrequent disruption with severe consequences.

Our disruption management framework evaluates both the probability of disruption and the predictability of consequences, and prescribes a SC strategy that fits best with the risk characteristics of disruption threats faced. Practitioners can use our framework to align the organization’s SC, RM, and overall operating strategies.

After reviewing existing supply chain risk management (SCRM) frameworks, we find several gaps worth investigating. To address these deficiencies, this article proceeds in the following manner. First, we review the dimensions of existing SCRM frameworks. We appraise several seminal frameworks to understand their contributions and limitations. This includes defining and assessing the four key processes relevant to most RM models: risk identification, assessment, mitigation, and responsiveness. Second, we introduce our own disruption management framework, which includes both the probability of disruption and the predictability of consequences. We then discuss four SC strategies: supply chain flexibility, risk and loss mitigation, agility, and resilience. This allows us to illustrate the utility and advantages of our framework through representative examples. We then discuss how our framework addresses the gaps identified within the SCRM literature. After reviewing the appropriate gaps, we predict how manag-
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