Chapter 75

Management of Risks in Sustainable Supply Chain Using AHP and Monte Carlo Simulation

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ABSTRACT

Business organizations are facing increasingly pressure from stakeholders to incorporate sustainable initiatives in the supply chains. In supply chain management, risk deals with the 'disturbance and disruption' in a variety of operations that consequences to undesired consequences. Sustainable supply chain (SSC) risk management is a supply chain strategy that aligns economic goals with a supply chain's ecological course of actions. In this chapter, an attempt is made to prioritize and manage the risks linked to SSC. The analysis has been done by combined Analytic Hierarchy Process (AHP) and Monte Carlo simulation (MCS) approach, which helps in distinguishing the priority of risks and revealing of the impacts of risk. Initially, the recognized risks are analyzed to know their priority using AHP technique. Next, the uncertainties related to the risks are explored. This is followed by a risk evaluation procedure to access the disruption impacts of these risks using MCS approach. This methodical approach helps in understanding of the probable risks and consequences to emerge in SSC.

INTRODUCTION

Supply chains (SCs) are the backbone of the today's economy as well as a main effect on the natural business and social environment. In today's world, every business organization is part of at least one supply chain (Van Der Vegt et al., 2015; Scholten and Fynes, 2017). According to the 2012 Living Planet Report, inhabitants are exceeding in the Earth's resources consumption by 50 percent - a per person resource consumption of one and half Earth's has been reported annually. In other words, it takes the earth 1.5 years to restore what person consumes through in a year; by 2050, the consumption of natural resources (virgin raw materials, minerals, etc.), is expected to rise exponentially. A significant scope of use of resources is recognized in manufacturing industry sector as well. One way to limit the utilization of the natural resources and environmental degradations is to consume less, as a result of which, a less quantity of resources will be needed from industrial viewpoints. Other way could be to use the resources in an efficient way (Shen et al., 2015).

To achieve this, it needs to implement sustainability oriented initiatives and its related procedures and methods in terms of either using some proficient and competent resource conservation practices, or using them in a responsible manner - emphasizing on more and more on recycling, reusing, remanufacturing (Luthra et al., 2016a). However, still, organizations are reluctant in adoption of sustainable initiatives (Sezen and Çankaya, 2017). The reason may be inadequacy in their knowledge of environmental, economic and societal benefits from sustainability initiatives in Supply Chains (SCs) (Ma et al., 2012). It involves different risks in taking sustainability initiatives (Mangla et al., 2015a). Consequently, it is significant to analyze and manage the risks in sustainability focused supply chain or Sustainable Supply Chain (SSC) to increase the overall performance and effectiveness in business (Mangla et al., 2014).

Specifically, the objectives of this chapter are –

1. To understand the various risks related to SSC
2. To prioritize the identified risks to establish their priority of concern in SSC
3. To access the potential consequences of the identified risks in SSC.

In this chapter, an attempt is made to prioritize and manage the risks linked to SSC. The outcome has not only been analyzed to capture the uncertainty, but also to analyze the risks.

The analysis has been done by combined Analytic Hierarchy Process (AHP) and Monte Carlo simulation (MCS) approach, which helps in distinguishing the priority of risks and revealing of the impacts of risk. Initially, the recognized risks are analyzed to know their ranking/priority using AHP technique. Next, the uncertainties related to the risks are explored. This is followed by a risk evaluation procedure to access the disruption impacts of these risks using MCS approach. This methodical approach helps in understanding of the probable risks and consequences to emerge in SSC.

This chapter has the seven sections. Section 1 provides the introduction and discusses the need of this work. Relevant literature on identification of risks in SSC has been presented in Section 2. Problem description of the case company has been given in Section 3. The used methodology is detailed in Section 4. Results and discussions of the present research are explained in Section 5. In the final section, Conclusions of research along with limitations and future research directions is provided.

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