Abstract No: MR-19

Classifying risk and vulnerability in the supply chain during an epidemic outbreak

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Companies always try to maximize shareholders' value by reducing the cost and maximizing profits in the long terms. However, one of the primary difficulties they face in doing so, is because of disruptions in the supply chain (SC). The supply chain can be disrupted due to natural disasters, manmade catastrophes, strikes, legal disputes, and special cases like epidemic outbreaks. The study explores what causes the supply chain to be disrupted in a company during an epidemic outbreak. It focuses on the Sri Lankan apparel industry as it contributes 6% to Sri Lanka's GDP and 44% percent to Sri Lanka's National Export Revenue, which is a significant proportion of the country's economy. The primary objective of this study is to identify the supply chain risks in order to be prepared, mitigate the effects and ensure business continuity. The study proposes a model to identify the SC risks and vulnerabilities during an epidemic outbreak, and which risks should be prioritized. The model was primarily developed through a systematic review of literature and information collected from experts in the apparel sector was used to validate the findings. Leading apparel manufacturing companies in Sri Lanka were selected through convenience sampling and managers with more than five years' experience were selected through random sampling. Using the output, the identified risks are then analysed and mapped in a vulnerability matrix considering cost and time factors. The model was tested and validated using 80%-20% rule. 80% of the collected data was used to develop the model and 20% of the collected data was used for testing and validation. Moreover, experts' opinions were also used to validate the vulnerability matrix. Loss of local key supplier, loss of international key supplier, local port closure, international port closure, transportation link disruption (other than ports), raw materials delays and shortages, human resource shortages, product demand variations, order cancellations and lead time variations are SC risks which are considered for this study. The loss of international key suppliers and order cancellations were classified as high risks, whereas, human resource shortages were classified as the least risk. Though, a generalized vulnerability model is developed in this study considering cost and time factors, it can be customized using different factors and risks depending on the experience and needs of the company. Participants for the survey assumed that customers are international, and suppliers are both local and international. The study can be further developed to identify the SC strategies which should be taken to mitigate the SC disruptions during an epidemic outbreak or during a major global crisis.

Keywords: Supply chain disruptions, Supply chain risks, Epidemic outbreak, Risk model, Vulnerability matrix