A MATHEMATICAL RECOVERY MODEL FOR MANAGING SUDDEN RISK IN SUPPLY CHAIN

Sanjoy Kumar Paul[1*]
[1]UTS Business School
University of Technology Sydney, Australia
sanjoy.paul@uts.edu.au

ABSTRACT

This paper aims to develop a recovery planning approach in a three-tier manufacturing supply chain, which has a single supplier, manufacturer, and retailer under an imperfect production environment, in which we consider three types of sudden risks: demand fluctuation, and disruptions to production and raw material supply, which are not known in advance. Firstly, a mathematical model is developed for generating an ideal plan under imperfect production for a finite planning horizon while maximizing total profit, and then we re-formulate the model to generate the recovery plan after happening of each sudden risk. Considering the high commercial cost and computational intensity and complexity of this problem, we propose an efficient heuristic, to obtain a recovery plan, for each risk type, for a finite future period, after the occurrence of a risk. The heuristic solutions are compared with a standard solution technique for a considerable number of random test instances, which demonstrates the trustworthy performance of the developed heuristics. We also develop another heuristic for managing the combined effects of multiple sudden risks in a period. Finally, a simulation approach is proposed to investigate the effects of different types of risk events generated randomly. We present several numerical examples and random experiments to explicate the benefits of our developed approaches. Results reveal that in the event of sudden risks, the proposed mathematical and heuristic approaches are capable of generating recovery plans accurately and consistently.

Keywords: supply chain disruption, quantitative recovery plan, sudden risk, heuristic, simulation.

* Corresponding Author