ABSTRACT

Managing and mitigating disruption risk has become an important research issue in the recent past. Disruption risk may occur in the form of natural disasters such as earthquakes, floods, and hurricanes; or man-made havocs such as terrorist attacks, and strikes. Disruptions have a strong influence on supply performance. In anticipation of these disruptive events, strategies must be designed by organizations as preventive measures. Several strategies have been discussed in the literature to mitigate supply disruption risks, and among them, multiple sourcing has been widely discussed. Greater assurance of timely delivery and more supply side volume flexibility are provided in multiple sourcing, due to the diversification of buying firm's order. On the contrary, cost of negotiations, managing supplier contract, monitoring the quality is increased. Therefore, a major task before the buying firm is to select the optimal number of suppliers and allocate order among them. In this regards, three analytical models are presented in the thesis to aid sourcing decisions, particularly supplier selection and order allocation under stochastic demand environment with complete and partial supply failure. In the first model, a risk-neutral decision maker's scenario is considered who intends to maximize the expected profit. The basic model is further analyzed under service level constraint and capacity constraint of the supplier. The capacity-constrained model is applied to study the milk collection policy of a dairy manufacturer. In the second model, the risk-neutral decision-making scenario is extended to risk-averse setting using mean-variance theory. In the third model, an option contract based strategy is proposed in the presence of a reliable backup supplier and spot market. The structural properties are studied for all the models. Based on this, the algorithms are proposed for both risk-neutral and risk-averse models. These algorithms guarantee optimal solutions while being tractable. Likewise, supply contracts are suggested for different strategic situations between a buyer and backup supplier to manage disruption risk.

Keywords: Supply chain, sourcing decisions, supply disruption risk, stochastic demand, supplier selection, order allocation, risk attitude, mean-variance analysis, nonlinear programming, game theory, algorithm