Supplier Risk Management: A Multivariate Statistical Modelling and Portfolio Optimization Based Approach for Supplier Delivery Performance Development

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Abstract : In this paper, the authors develop a stochastic model regarding the investment in supplier delivery performance development from a buyer's perspective. The authors propose a multivariate model through a Multinomial-Dirichlet distribution within an Empirical Bayesian inference framework, representing both the epistemic and aleatory uncertainties in deliveries. A closed form solution is obtained and the lower and upper bound for both optimal investment level and expected profit under uncertainty are derived. The theoretical properties provide decision makers with useful insights regarding supplier delivery performance improvement problems where multiple delivery statuses are involved. The authors also extend the model from a single supplier investment into a supplier portfolio, using a Lagrangian method to obtain a theoretical expression for an optimal investment level and overall expected profit. The model enables a buyer to know how the marginal expected profit/investment level of each supplier changes with respect to the budget and which supplier should be invested in when additional budget is available. An application of this model is illustrated in a simulation study. Overall, the main contribution of this study is to provide an optimal investment decision making framework for supplier development, taking into account multiple delivery statuses as well as multiple projects.