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Editorial

Discrete Dynamic Gaming Models in Supply Chain Management and Project Management

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In the fields of supply chain management and project management, researchers and practitioners have established enormous models to describe, explain, and solve practical problems occurring in the industry. However, the real world is so complex because of the dynamics and uncertainty embedded in a variety of environmental parameters, such as market demand, supply of raw materials, price of raw materials and finished products, the transportation and delivery time, production processing time, and budget. As a result, it is extremely challenging for firms to make their optimal decisions. In addition, the vertical and horizontal competition and coordination among different parties simply make the difficulty grow in an order of magnitude, especially considering the interactive and dynamic social and economic activities. Therefore, applying the discrete dynamic gaming models to industrial practices, while allowing for the randomness of environmental factors and the interactions of different participants, provides a useful and powerful way to resolve many complex practical issues. This special issue is dedicated to such models.

One of the papers studies a three-level supply chain consisting of one manufacturer, one distributor, and one retailer facing a stochastic and sales effort dependent market demand. While the traditional revenue-sharing mechanism cannot coordinate the supply chain perfectly, the authors propose augmented mechanisms based on quantity discount to improve the supply chain performance. Another paper considers the joint production planning of complex supply chains constrained by carbon emission reduction policies. The authors incorporate input-output model to capture the interrelated demand link in an arbitrary pair of two nodes in scenarios with or without carbon emission limits. Two typical carbon emission reduction policies are studied to examine how carbon emission reduction policies affect the profit and carbon emission of a particular supply chain. Another paper explores how the joint carbon emission reduction of the manufacturer and the retailer impacts a dyadic supply chain. A new side-payment contract is designed to coordinate the whole supply chain.

One of the papers investigates a make-to-stock system with controllable demand rate by varying selling price and adjustable service rate by outsourcing production. It shows that the optimal control policy is of threshold type depending on the inventory position. Another paper considers a closed-loop supply chain network equilibrium problem in multiperiod planning horizons with constraints on product lifetime and carbon emission cap. The network consists of four tiers, suppliers, manufacturers, retailers, and consumers. Based on the variational inequality and complementary theory, the optimal behaviors of different tier players are characterized, and the governing closed-loop supply chain network equilibrium model is established. The equilibrium is obtained using a modified project contraction algorithm with fixed steps. One of the papers considers a technical problem on the uncertainty of supply chain network design. As the spatial location areas become extremely large, it is a big

challenge to evaluate the covariance matrix determined by the set of location distance even for gridded stationary Gaussian process. To alleviate the numerical challenges, the authors construct a nonparametric estimator, called periodogram of spatial version, to represent the sample property in frequency domain. Under some regularity conditions on the process, the asymptotic unbiasedness property of periodogram as estimator of the spectral density function is investigated and the convergence rate is demonstrated.

Another paper studies the horizontal coalition stability problem of players in a two-stage supply chain consisting of one supplier and multiple dealers. The first stage game is a vertical sequential game with the supplier being the leader and the dealers being the followers. While at the second stage, multiple dealers either play the Nash game separately or form a coalition as a whole. Another paper explores the cost allocation mechanism in public-private partnership projects based on the theory of contracts as reference points. Some managerial insights are provided from the derivation of the optimal investment ratio. One of the papers considers a new scheduling problem where emergency jobs suddenly appear during the processing of a particular job and must be processed immediately upon the completion of the current job. The processing times of all jobs are random and should be completed on a single machine. Two objective functions, the weighted sum of waiting times and the weighted discounted cost of waiting times, respectively, are proposed based on industrial practices (e.g., the surgery problem). Optimal polices are addressed to minimize the corresponding objectives.

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