Contributions to humanitarian logistics

The purpose of this special issue of *IISE Transactions on Scheduling and Logistics* is to create a repository of cutting-edge industrial engineering research work in the area of humanitarian logistics. An open call for papers on *IISE Transactions* was announced in September 2017. The six articles published herein were selected among 20 submitted manuscripts, following the standard, rigorous review procedure of *IISE Transactions*.

The papers can be separated into two categories. The first category includes three articles that relate to resource location, where resources can be interpreted as relief distribution items as well as shelters (Mostajabdaveh et al., Setiawan et al., and Aslan and Celik). The second category includes three articles that are focused on improved modeling and algorithmic approaches for humanitarian logistics problems (Li and Chung explore the impact of data uncertainty, Yu et al. explore the use of rollout algorithms, and Wang and Nie explore the impact of traffic congestion).

The first paper entitled “Inequity-averse shelter location for disaster preparedness,” by M. Mostajabdaveh, W. J. Gutjahr, and F. Sibel Salman studies the problem of selecting a set of shelter locations in preparation for natural disasters. Their modeling framework includes both efficiency and inequity. To achieve this, they minimize a linear combination of: (i) the mean distance between opened shelter locations and the locations of the individuals assigned to them; and (ii) Gini’s Mean Absolute Difference of these distances. A stochastic programming model with a set of scenarios that consider uncertain demand and disruptions in the transportation network is developed. A specialized Genetic Algorithm is developed to solve large problem instances. A case study based on Istanbul data is presented to derive insights for decision-makers.

The second paper entitled “Resource location for relief distribution and victim evacuation after a sudden-onset disaster,” by E. Setiawan, J. Liu, and A. French studies the problem of positioning medical and relief distribution facilities after a sudden-onset disaster event. The study is developed around the events that occurred after the West Sumatra earthquake. There are three models analyzed, that explore various levels of collaboration between evacuation and relief distribution. For larger problem instances, heuristics are developed. Their results show that increasing cooperation between resources that are used for evacuation and those used for relief distribution can significantly improve system performance.

The third paper entitled “Pre-positioning of relief items under road/facility vulnerability with concurrent restoration and relief transportation,” by E. Aslan and M. Çelik focuses on the design of a multi-echelon humanitarian response network, where the pre-disaster decisions of warehouse location and item pre-positioning are subject to uncertainties in relief item demand and vulnerability of roads and facilities following the disaster. The model assumes a scenario where road repairs are conducted after the disaster to improve network connectivity while at the same time relief item supplies are delivered. A two-stage stochastic program is formulated to model this system and a sample average approximation scheme is proposed for its heuristic solution. The results are illustrated on a set of computational experiments on a potential earthquake scenario in Istanbul, Turkey.

The fourth paper entitled “Disaster relief routing under uncertainty: A robust optimization approach,” by Y. Li and S. H. Chung addresses the Capacitated Vehicle Routing Problem (CVRP) and the Split Delivery Vehicle Routing Problem (SDVRP), in the context of uncertain travel times and demands. A robust optimization approach is used for CVRP and SDVRP considering five objective functions: minimization of the total number of vehicles deployed, the total travel time/travel cost, the summation of arrival times, the summation of demand-weighted arrival times, and the latest arrival time. A two-stage heuristic method that combines the extended insertion algorithm and Tabu search is developed to solve the resultant VRP models. The solutions of CVRP and SDVRP are compared using five different metrics. The results demonstrate that SDVRP is more effective that CVRP in mitigating demand and travel time uncertainty.

The fifth paper entitled “Rollout algorithms for resource allocation in humanitarian logistics,” by L. Yu, H. Yang, L. Miao, and C. Zhang analyzes resource allocation, which includes three metrics (efficiency, effectiveness, and equity) with respect to economic cost, service quality, and fairness. A nonlinear integer model is proposed. The solution of the model is achieved through an equivalent dynamic programming model that avoids the nonlinear terms created by the introduction of the deprivation cost. An approximate dynamic programming algorithm, called the rollout algorithm, is developed to solve large problem instances. Extensive numerical experiments are conducted to test the performance of the proposed algorithms, and the experimental results demonstrate that the rollout algorithm yields optimal or near-optimal solutions within a reasonable amount of time.

The sixth paper entitled “A stochastic programming model for emergency supply planning considering traffic congestion,” by A. Wang and X. Nie explores the role of traffic congestion in emergency supply planning models.
Traffic congestion effects are incorporated via a two-stage location-allocation model that facilitates the planning of emergency supply pre-positioning and post-disaster transportation. The mixed-integer nonlinear programming model is solved by applying a generalized Benders decomposition algorithm. A case study based on a hurricane threat in the southeastern United States is used to illustrate the impact of considering traffic congestion. Managerial insights about the supplies pre-positioning plan and traffic control policy are also developed.

We hope that the articles in this special issue will add to the measured successes of IISE Transactions in publishing novel results in Scheduling and Logistics.

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