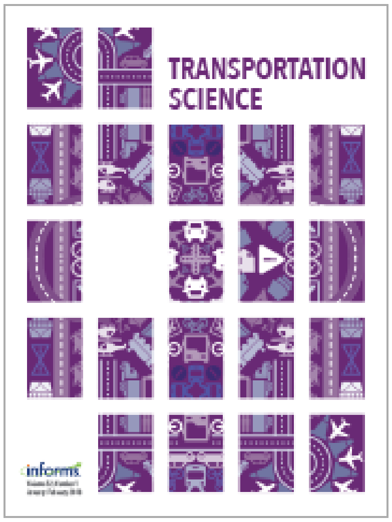

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Special Issue on 2021 TSL Workshop: Supply and Demand Interplay in Transport and Logistics

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In an era of urbanization and rising demands for efficient transportation, understanding the interactions between supply and demand in complex transport systems has become an imperative research focus. This special issue assembles a cross-disciplinary array of papers to critically engage with the mathematical models, computational algorithms, and data-driven methodologies that shed light on these dynamic interactions. Supply and demand interplay in transport and logistics was the focus of the 2021 Transportation Science and Logistics Workshop held online (because of COVID) and organized by Erasmus University Rotterdam, and it is, therefore, also the focus of this associated special issue.

The theme of the workshop was "Interaction in Transport and Logistics," more specifically, we aimed capturing the supply and demand interplay in transport and logistics systems. In many transportation systems, a mismatch between the associated design and planning decisions (supply) and the usage and consumption patterns (demand) is typically encountered. A tailored system is not only appealing to operators, who could have a better knowledge of their operational costs, but also to users because they would benefit from an increase in the level of service and satisfaction. Hence, it is important to explicitly allow for the interactions between the two in the model governing the decisions of the system.

Our overarching objective with this special issue of *Transportation Science* is to provide a forum for novel and interdisciplinary research, emphasizing fundamentally new perspectives on the opportunities that have emerged in transport and logistics systems. Among the submitted manuscripts, three papers were accepted for this special issue. The featured articles delve into diverse aspects of transport challenges. To gain a better understanding of the core focus of this special issue, we provide brief highlights of the contributing papers as follows.

1. Kinay, Gzara, and Alumur investigate the problem of determining the strategic location of charging stations and their capacity levels under stochastic electric vehicle flows and charging times considering the route choice response of users. The problem is modeled using bilevel optimization in which the network planner or leader minimizes the total infrastructure cost of locating and sizing charging stations, ensuring a probabilistic service requirement on the waiting time to charge. Electric vehicle users or followers, on the other hand, minimize route length and may be cooperative or noncooperative. Their choice of route, in turn, determines the charging demand and waiting times at the charging stations and, hence, the need to account for their decisions by the leader. The bilevel problem reduces to a single-level, mixed-integer model using the optimality conditions of the follower's problem when the charging stations operate as M/M/c queues and the followers are cooperative. To solve the bilevel model, a decomposition-based solution methodology is developed that uses a new logic-based Benders algorithm for the location-only problem. Computational experiments are performed on benchmark and real-life highway networks, including a new Eastern U.S. network. The impact of route choice response, service requirements, and deviation tolerance on the location and sizing decisions are analyzed. The analysis demonstrates that stringent service requirements increase the capacity levels at open charging stations rather than their number and that solutions allowing higher deviations are less costly. Moreover, the difference between solutions under cooperative and uncooperative route choices is more significant when the deviation tolerance is lower.

2. Heinold, Meisel, and Ulmer introduce a framework that incorporates eco-labeling for dynamic routing of an intermodal network. They model the problem as a multiobjective, sequential decision process and propose

a reinforcement learning method, value function approximation (VFA). VFAs frequently simulate trajectories of the problem and store observed values (violated eco-labels and costs) for states aggregated to a set of features. The observations are used for improved decision making in the next trajectory. They tackle two additional challenges when applying a VFA, the multiple objectives and the "delayed" realization of eco-label satisfaction because of future consolidation. For the first, they propose different feature sets dependent on the objective function's focus, costs, or eco-labels. For the latter, they suggest enhancing the suboptimal decision making and observed pessimistic primal values within the VFA trajectories with optimistic dual decision making when all information of a trajectory is known ex post. This enhancement is a general methodological contribution to the literature of approximate dynamic programming and will likely improve learning for other problems as well. The authors show the advantages of both components in a comprehensive study for intermodal transport via trains and trucks in Europe.

3. Müller, Gönsch, Soppert, and Steinhardt introduce customer-centric dynamic pricing for a free-floating vehicle-sharing system. To address the imbalances of supply and demand in such networks, pricing has proven to be an effective and cost-efficient means. The fact that customers use mobile applications combined with the fact that providers know the exact location of each vehicle in real time provides new opportunities for dynamic pricing. In this context of modern vehicle-sharing systems, the authors develop a profit-maximizing dynamic pricing approach that is built on adopting the concept of customer-centricity. Customer-centric dynamic pricing here means that, whenever a customer opens the provider's mobile application to rent a vehicle, the price optimization incorporates the customer's location as well as disaggregated choice behavior to precisely capture the effect of price and walking distance to the available vehicles on the customer's probability of choosing a vehicle. Two other features characterize the approach. It is origin-based, that is, prices are differentiated by location and time of rental start, which reflects the real-world situation in which the rental destination is usually unknown. Further, the approach is anticipative, using a stochastic dynamic program to foresee the effect of current decisions on future vehicle locations, rentals, and profits. They propose an approximate dynamic programming–based solution approach with nonparametric value function approximation. It allows direct application in practice because historic data can readily be used and main parameters can be precomputed such that the online pricing problem becomes tractable. Extensive numeric studies, including a case study based on Share Now data, demonstrate that the approach increases profits by up to 8% compared with existing approaches from the literature.

The exciting developments in transport systems have encouraged researchers to address a variety of problems faced by practitioners. Whereas these three papers address distinct problems, collectively, they underscore numerous challenges and opportunities within user-centric transport systems. We hope that this special issue will serve as a useful resource for researchers and practitioners to foster new ideas, models, and solution algorithms and, ultimately, inspiring the advancement of more efficient and user-friendly systems.

This special issue would not have been possible without the careful attention given by the reviewers. We also thank the editor-in-chief, Professor Karen Smilowitz, for the opportunity and support to publish this special issue of *Transportation Science*. Finally, we sincerely thank the editorial team for their patience and continuous support.