A Mathematical Programming Framework that Integrates Customer Decisions within the Distribution Planning of Petroleum Products

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Abstract

This paper develops a methodological framework for designing the daily distribution and replenishment operations of petroleum products by simultaneously considering the perspectives of both the transporter and its customers. Over the last few decades a wide variety of distribution problems have been studied in the form of vehicle routing problems. Nevertheless, many of those approaches assume that the customers' decisions are completely decoupled from those of the transporter. i.e., the order quantities and expected delivery time windows are given to the transporter as hard constraints. Most models assume that there are always feasible routes that satisfy such requirements. In contrast, in competitive markets like the one of petroleum products—in which the transportation decisions must also meet strict regulatory policies—finding feasible solutions that cope with all customer and governmental requisites is often impossible. We provide empirical evidence that minor alterations to the customer requirements, triggered by some strategic decisions by the transporter, can in turn flexibilize the transporters' restrictions, allowing for better routing strategies that reduce late deliveries. In this context, the transporter has no direct control over the customers' inventory planning. Therefore, if the transporter wants the customers to select more favorable requirements (e.g., wider delivery time windows), the transporter must provide incentives to the customers for selecting more lenient alternatives (e.g., discounts for wider time windows) or impose some mild restrictions (e.g., blocking a few time windows). The main objective of this project is studying the interactions that exist between these strategic and operational decisions within a unified approach.

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