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Collaborative transportation with overlapping coalitions. (English) Zbl 1403.90115

Summary: Most literature on collaborative transportation has focused on cost allocation, assuming as given which companies take part in the collaboration. However, a primary problem is the formation of coalitions. In this article, we study the so-called coalition configuration problem, in which any company can collaborate in more than one coalition. This is more general than the classic coalition structure problem, where a company must belong to only one coalition. We develop two approaches for coalition configuration in transportation. One is area-driven, which assumes the whole territory is divided into areas and then finds coalitions within each area by integer linear models. The other approach consists of a mixed integer linear programming model that embeds the coalition configuration in the transportation problem. Our motivation comes from a real world case in the forest fuels industry in Sweden, involving 27 companies, 200,000 transports, and 6 million tons of forest biomass, equivalent to 17 tera-Watt hours of energy consumption. Collaborative transportation renders about 8% of potential cost savings in this case, and may also help to increase the use of bioenergy. The coalition configuration increases by about 2.5% the savings obtained by the coalition structure and is competitive with the savings of the grand coalition.

MSC:
90B06 Transportation, logistics and supply chain management
90C05 Linear programming
91A80 Applications of game theory
91A12 Cooperative games

Keywords: transportation; OR in natural resources; collaborative logistics; coalition configuration; forest transportation

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