

From newsvendor to waste management network design: Marketing decisions by decision-dependent stochastic demand

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Abstract:

The presentation deals with the development, modeling, and analysis of demand-based problems containing marketing, operations, and logistics decisions. Two demand-based problems are presented: a) the newsvendor problem, due to its simple structure as a suitable tool for illustrating how facets of marketing may affect decision-making concerning operational problems, and b) the network design problem, which is modeled on a real waste management network and where some results and knowledge gained from the newsvendor problem are applied..

In the setting presented, the newsvendor is faced with advertising-sensitive stochastic demand. A demand-related random element comprises the particular marketing decision of a specific form (e.g., multiplicative or additive). It is assumed that a suitable advertising strategy results in increased sales. The properties of the obtained optimal decisions for particular models are discussed.

Then, a scenario-based two-stage stochastic integer nonlinear program for supporting strategic decision-making in the important application area of municipal solid waste management is introduced. The key modeling idea is to apply modern principle ideas of so-called circular economy to the complex waste management problem, where the primary goal tends to reduction of waste produced. The generated waste should be preferably recycled as much as possible and the resultant residual waste might be used for energy recovery.

Only some waste residues are appropriate for landfilling. The aim is to propose the optimal waste allocation for its suitable processing and also find an optimal waste transportation plan at an operational level. In addition, the key strategical decisions must be made about location of waste treatment facilities. Since waste production is very often hard to predict and control, the formulated optimization model considers the waste production as a stochastic decision-dependent quantity. To support the aforementioned circular economy ideas, the advertising and pricing principles that have recently been applied to decision-making problems in several application areas are introduced, discussed, and included into the designed model..