

Optimal Operation Policies for Vendor Machines with Product Dedicated Variant Towers

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Abstract

In recent years, the level of competition extremely increased for all markets. Due to globalization, similar products and services are offered by many players. In order to become stronger in this competitive environment, all players must act strategically and enhance their supply chain management activities. Some companies try to extend their market share from wholesale level to retail and lower levels. This strategy forces companies to reach customers by vendor machines. The aim of this study is to develop a mathematical model to optimally manage operations of vendor machines carrying multi-items located at different locations. The considered problem handles pricing, routing, inventory management and capacity planning problems. We seek an optimal solution that will answer the following research questions: (1) Which items should be available at each location and how many towers should be allocated for those items? (2) What should be the optimum inventory level of these items at the beginning of each period? (3) Shall there be any item transfer between locations at each period of time? (4) What should the price for each item at each location and at each time period be? Our model considers the uncertainty in demand of the items with the help of scenarios. The proposed model is checked by several functional tests to verify that the model works properly and gives the expected results. By conducting numerical experiments, we understand that our model provides efficient solutions to the problem with uncertainties. We also compare the results of the model with the results of a heuristic approach. When compared with the mathematical model, heuristic approach does not produce efficient results for the locations without direct link to the supply centers. The results support usage of the proposed mathematical model.

Keywords

Vendor Machine, Inventory Management, Dynamic Pricing, Heuristic

Biographies

Ertan Yakici is an Associate Professor in the Industrial Engineering Department of Turkish Naval Academy of National Defense University, Istanbul, Turkey. He received his BS degree from the same department in 1999. He holds a MS degree from H. Milton Stewart School of Industrial and Systems Engineering at the Georgia Institute of Technology, a MBA degree from Cankaya University and a Ph.D. degree from the Middle East Technical University. From 2004 to 2014, he has worked as an analyst in the Department of Decision Support in the Navy. In 2014, he joined Turkish Naval Academy. He teaches courses on operations research, stochastic processes, heuristics and decision theory. His current research interests include military operations research problems, routing and location-routing problems.

Haci Sahin is a MS degree student in the Department of Industrial Engineering of the Middle East Technical University. He received BS degree from the same department in 2009. From 2010 to 2014, he has worked at Turk Telekom Inc., telecommunication operator of Turkey, as specialist. In 2014, he started to work in the Operations Department of Enerjisa Enerji Inc., leading energy company of Turkey.

Duran is a Professor in the Industrial Engineering Department of Middle East Technical University and has received his BS degree from the same department in 2002. He holds two master degrees and a Ph.D. from H. Milton Stewart School of Industrial and Systems Engineering at the Georgia Institute of Technology. During his PhD studies he worked as an operations research analyst on logistics projects for both profit and non-profit organizations. He has taught courses on revenue management, financial accounting and engineering economy at Middle East Technical University and his research interests include operations research applications in humanitarian logistics, energy sector and demand management.