

Multiskilling with closed chains in a service industry : a robust optimization approach

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Abstract

Variability and seasonality is an inherent characteristic in many service industries. This leads to the problem of mismatch between employee supply and demand. In this work we present a mixed integer linear programming model and a constructive heuristic to address this problem. The proposed methodology applies the concept of multiskilling, an attractive source of flexibility for improving service levels and reducing the costs to firms of staff shortages and surpluses induced by employee demand variability. The model structures the multiskilling characteristics of a set of employees. Initially deterministic, the model is then modified to incorporate a robust optimization approach in which demand uncertainty is explicitly included. A Monte Carlo simulation is conducted to evaluate the model's robust solutions for different levels of demand variability and decision-maker risk aversion. The methodology creates closed-chain multiskilling structures of different lengths with excellent cost-effective performance for each variability level. Finally, some user guidelines are defined for choosing the appropriate risk aversion level and generating a skills training plan that will ensure most of the total potential benefits of multiskilling are actually obtained with an investment much less than what would be required by the most conservative (i.e., worst case) robust solution..

Keywords

Chaining, Multiskilling, Robust optimization, Service industries, Unbalanced systems, Workforce flexibility.