

Title: A hybrid DEA-based K-means and shuffled frog-leaping algorithm for maintenance selection

Author: Farshad Faezy Razi

Address: Department of Industrial Management, Semnan Branch, Islamic Azad University, Semnan, Iran

Abstract: One of the main topics in repair and maintenance management lies is a matter of selection of repair and maintenance activities. This issue inherently deals with multiple and diverse quantitative and qualitative criteria for the purpose of decision-making and the selection. For this reason, the present paper has presented a new methodology for multi-criteria decision-making to select among various maintenance and repair activities. In the proposed approach, repair and maintenance activities are initially clustered using K-means clustering algorithm. The optimal number of clusters in K-means algorithm is validated using Silhouette Index. After determining optimal number of clusters, efficiency of repair and maintenance activities in each cluster is measured using data envelopment analysis. The fuzzy inference system is used to predict risk of unavoidable repairs and maintenance activities studied in this paper. Then, a two-objective mathematical programming model is designed, which not only maximises efficiency of maintenance activities, but also minimises the risk attributed to maintenance activities. Pareto optimal solution relevant to discussed model is obtained using shuffled frog-leaping algorithm. A case study is used to intuitively express multi-criteria problem of selection of repair and maintenance activities.

Keywords: k-means clustering; CCR-DEA; maintenance selection; shuffled frog leaping algorithm; SFLA; fuzzy inference systems; FIS; maintenance management; repair activities; multicriteria decision making; MCDM; data envelopment analysis; DEA.