

Multi-Criteria Group Decision-Making for Fire Station Staffing

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Abstract

Determining staffing requirements for a fire station is quite difficult as one must balance between the cost of additional human resources and the risk of not having an effective force to respond to a given incident. This paper presents an application of a novel AHP-based methodology, incorporating multiple decision makers and multiple decisions, to fire station staffing in a large residential and industrial complex. A new practical and comprehensive model is formulated for fire station staffing. The model can be summarized as a two-stage approach. The first stage is applying AHP to each decision and each decision maker. The second stage is integrating the individual decisions in order to reach group consensus in both decisions. A novel technique is used to assign weights to different decision makers based on their varying consistency levels. The proposed method is simple but effective, and it allows for the objective assessment of the alternatives and for providing a ranking of the multiple decisions. The method utilizes the fact that no decision maker is perfectly consistent, and hence it gives higher weights to decision makers with greater degrees of consistency. The method integrates the different decisions into a ranked arrangement for final decisions using the weighted scores for the combination of decision alternatives.

Keywords

Analytic hierarchy process (AHP); Multi-criteria decision making; Group decision; Fire station staffing; Consistency-based weights.

Biographies

Abdulaziz S. Alzahrani is currently working as Organization Performance Advisor at Saudi Aramco and has more than 6 years of total professional experience in various fields from IT Project Management, Business Process Re-engineering, and Management Consulting. Abdulaziz earned his bachelor's degree in Industrial & Systems Engineering from King Fahad University of Petroleum & Minerals (KFUPM) in January 2013, and currently pursuing his master from the same institution. He has also won the "Excellence in Academic Research" award in 2018 and 2019 at the Annual KFUPM Student Forum. Abdulaziz highlights his Professional Interests as Data Analytics, Workforce Optimization and Modelling, and Operations Research.

Hesham K. Alfares is Chairman and Professor in the Systems Engineering Department at King Fahd University of Petroleum & Minerals, Dhahran, Saudi Arabia. He has a PhD in Industrial Engineering from Arizona State University. He has more than 110 publications, including 56 journal papers and a U.S. patent. Dr. Alfares has been as a visiting scholar at MIT and the University of North Carolina in the USA, in addition to four universities in the UK. He won one research grant from the US Fulbright Foundation, and four grants from the British Council. He won the Almarai

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