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Extension of an integrated AHP and TOPSIS approach in water resources management

Yasser Minatour[1], Jahangir Khazaei[2], Azadeh Gholami[3]
1, 3. M.Sc. Student of Water Eng., Dept. of Civil Eng., Razi Univ., Kermanshah, Iran. Email: yasser.4607@gmail.com, gholami.azadeh@yahoo.com
2. Assist. Prof. of Civil Eng., Dept. of Civil Eng., Razi Univ., Kermanshah, Iran. Email: J.khazaie@razi.ac.ir

Abstract

This study aims to develop MCDM approach in water resources management, for this purpose an integrated AHP and TOPSIS approach was applied in the Harsin earth dam site selection at the western part of Iran. To do this, firstly the influential criteria for locating the earth dam site were determined using comprehensive literature review and the opinions of experts. Then, some watersheds in the surrounding areas of Iran's Harsin city were studied and four feasible sites proposed. In the final stage, these sites were prioritized using this proposed approach, and the most optimal site was selected. AHP was used to determine the relative weight of criteria and TOPSIS was used to rank alternatives.

Keywords: AHP, Dam site Multi-Criteria Decision Making (MCDM), TOPSIS, Water resources management.

Introduction

Optimal locating the dam site is one of problems associated with water resources management and it depends on a set of qualitative and quantitative criteria. In addition, dam construction inflicts high costs and it should be constructed in a site with higher potential to compensate the costs. In this situation in order to locate the optimal dam site, various studies must be conducted. As this issue is related to different qualitative and quantitative criteria, decision making in this area is complex act. Therefore, in order to solve this problem, multi-criteria decision making (MCDM) methods could be used. MCDM is one of the branches of operation research which investigates the decision making problems under some decision making criteria. This kind of decision making utilizes a number of criteria instead of solely one optimal assessment criterion. MCDM is categorized into two main groups of multi-objective decision making (MODM) and multi-attribute decision making (MADM) (Pohekar and Ramachandran 2004). The aim of the MODM problems is the simultaneous optimization of a number of target functions under a series of limitations. Generally, MODM techniques are applied to design and optimization problems. The MADM methods are used for selecting the best alternative amongst various alternatives and obtaining a ranking for the alternatives. different methods have been presented for MADM, including: compromise programming (Charnes and Cooper 1961); elimination et choice translating reality (ELECTRE) (Benayoun etal, 1966; Roy, 1968); analytic hierarchy process (AHP) (Saaty, 1980); simple additive weighting (SAW) (Hwang and Yoon, 1981); technique for order preference by simulation of