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Multicriteria analysis strategies in technical project management

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ABSTRACT

The subject of this master thesis is the composition of an original method of multicriteria analysis and evaluation which is a new strategic approach for problems in the area of technical project management. The method is based on: a) the modeling of the problem with the use of the extended lexicographic method (ELGP) of goal programming b) analyzing and determining the importance of the criteria through information entropy of the performance of the alternatives c) in the formulation and solution of different scenarios (instances) using information systems that match decision-makers' preferences and possible future conditions d) in the evaluation of the results as uncertain and incomplete with two methods: The GRA method (Grey Relational Analysis)based on the theory of grey systems (Grey Systems Theory) and a modified implementation of the SIMUS method (Sequential Interactive Model for Urban Systems). The developed method allows direct trade off and sensitivity analysis of the results with the use of information systems. Moreover, it allows a project management team to: a) Obtain reliable and objective analysis results, b) Manage easily large volumes of data of the problem. c) Model a wide scale of problems in project management, d) consider different scenarios of the problem, e) fully support their decisions and evaluations f) analyze the robustness of the results, g) directly introduce decisionmakers' different preferences. The synthesis of the method was preceded by a) a description of key components and relevant characteristics of technical projects in regard to multicriteria analysis b) the description of the basic elements and methodological framework of multicriteria analysis and its strategies in project management c) the description and development of existing important multicriteria analysis methods which are applied frequently in project management. Two project management cases studies are examined using three conventional multicriteria methods (MAUT, TOPSIS, PROMETHEE II). The first case study refers to a selection problem on behalf of the public sector involving specific investments proposals in construction projects for the development of a coastal land area. The second case study refers to a complex problem of selection, resource allocation and corporate strategy which involves the construction of electrical energy projects of different technology, size, in different parts of Greece in accordance to the DBFO model (Design, Build, Finance, Operate). By applying the above conventional multicriteria methods for both problems, it is demonstrated that there is a range of inherent weaknesses that prevent the successful implementation of these methods in complex project management problems. The second case is analyzed with the newly developed method using VBA (Visual Basic for Applications) programming and Solver in MS Excel. The results of the application highlight the characteristics of the newly developed method.

KEYWORDS

Multicriteria analysis, Extended lexicographic method, Mulricriteria goal programming