Multi-criteria Decision-making in Situations with a Large Number of Alternatives

Amir Hessami
Civil and Architectural Engineering Department
Texas A&M University–Kingsville
Kingsville, TX 78363, USA
amir.hessami@tamuk.edu

Joon-Yeoul Oh
Mechanical and Industrial Engineering Department
Texas A&M University–Kingsville
Kingsville, TX 78363, USA
joon-yeoul.oh@tamuk.edu

Abstract

A decision making process sometimes becomes overwhelming in situation where the criteria for a successful decision are complex, and when there are numerous possible alternative actions to consider. To precisely compare alternatives, the ideal approach is to use a pair-wise evaluation in which each option is carefully weighed against every other option. However, in real-world situations such rigorous evaluations often cannot be undertaken due to time limitations and the large number of possible options. To address this problem, this paper presents a novel decision-making process for situations in which there are a large number of alternatives and multiple criteria. The proposed decision-making technique combines a profile model, a checklist model, and an analytical hierarchy process. An example is provided in which the proposed method is used to select from among thirty alternatives with three criteria. Applications of this approach to problems with even greater numbers of alternatives and success criteria are also possible. This proposed approach can be applied by transportation managers who are seeking to prioritize maintenance projects within an extensive roadway network, or construction managers who are deciding among different materials while evaluating complex factors such as weight, expense, and holding capacity.

Keywords

Decision-making, Profile Model, Checklist Model, Analytical Hierarchy Process

Author Biographies

Amir Hessami is an assistant professor of construction management in the Department of Civil and Architectural Engineering at Texas A&M University–Kingsville (TAMUK). He holds a Ph.D. in Civil Engineering (Construction Management) from Texas A&M University, an M.Sc. in Civil Engineering (Hydraulic Structures) from Sharif University, and a B.Sc. in Civil Engineering from Ferdowsi University. His research is in the areas of infrastructure asset management, project management, and
construction management, with a focus on decision-making under uncertainty, risk analysis, and life-cycle cost analysis. Dr. Hessami’s background includes more than fifteen years of research, teaching, and practical experience in the planning, design, construction, and maintenance of infrastructure projects.

**Joon-Yeoul Oh** is an associate professor of Department of Mechanical and Industrial Engineering at Texas A&M University–Kingsville (TAMUK). He earned a Ph.D. and M.Sc. in Industrial Engineering from New Mexico State University and a B.Sc. in Industrial Engineering from Chong-Ju University. His work is in the area of operations research and engineering management, focusing on risk analysis, risk management and responses, project management, network optimization, wireless telecommunication network expansion and optimization, non-linear programming, heuristic algorithms, integer programming, linear programming, queueing theory, information systems engineering, and algorithm development. Dr. Oh has more than 15 years of teaching and research experiences at TAMUK and has published more than 50 journal and conference papers. His recent projects include emergency response-time optimization, improving garbage collection routing, and developing real-time aid for evacuation routing.