

# ENVIRONMENTAL DECISION MAKING – A HYBRID APPROACH

**Rakesh Verma**

Operations Management Group,  
National Institute of Industrial Engineering (NITIE),  
Mumbai, 400087 (INDIA)  
[rakeshverma@nitie.edu](mailto:rakeshverma@nitie.edu)

**Saroj Koul\***

Jindal Global Business School,  
OP Jindal Global University,  
NCR of Delhi, 131001 (INDIA)  
[skoul@jgu.edu.in](mailto:skoul@jgu.edu.in)

## Abstract

Environmental decision-making is a process of weighting alternatives and selecting the most appropriate alternative, by integrating results of risk assessment with social, economic, political and engineering data to reach a rigorous decision. Decision-making tools help in the selection of prudent, technically feasible, and scientifically justifiable actions to protect the environment and human health in a cost-effective way (Sadiq, 2001). The main challenge in environmental decision-making is that alternatives are multiple and diverse in nature, and often have conflicting criteria. Multiple criteria decision-making (MCDM) methods are employed where alternatives are predefined and the decision-maker(s) ranks available alternatives based on the evaluation of multiple criteria. MCDM often called multi-criteria decision aid (MCDA) and multi-criteria analysis (MCA), is a set of methods which allow the aggregation and consideration of numerous (often conflicting) criteria in order to choose, rank, sort or describe a set of alternatives to aid a decision process. The ability of MCDM to address the numerous quantitative and qualitative criteria that affect environmental decision-making process makes it appropriate for the said topic.

There are three steps that all MCDM techniques follow – 1) Determine relevant criteria and alternatives; 2) Attach numerical measures to the relative importance of the criteria and to the impacts of the alternative on these criteria; 3) Process the numerical values to determine a ranking of each alternative.

Analytic Hierarchy Process (AHP) is one of the most commonly used utility-based methods for environmental decision-making (Sadiq, 2001). The AHP uses objective mathematics to process the subjective and personal preferences of an individual or a group in decision-making (Saaty, 2001).

**\* Corresponding Author**

Complex proportional assessment (COPRAS) method (Zavadskas, Kaklauskas, 1996) was applied to the solution of various problems in construction (Kaklauskas et al., 2007) and assessment of road design solutions. COPRAS method has been used to define the utility and market value of real estate and for measuring sustainable city. COPRAS, along with TOPSIS, were used in the evaluation of social and economic development of Lithuanian regions.

This paper presents a hybrid approach of a combination of AHP and COPRAS to select the best alternatives under multiple environmental criteria and is demonstrated with a detailed illustrative example.

**Keywords:** Multiple criteria decision-making, MCDM, Analytic Hierarchy Process, AHP, Complex proportional assessment method, COPRAS, Environmental decision-making,

### **References:**

1. Sadiq R., (2001). *Drilling Waste discharges in the marine environment: a risk-based decision methodology*. Ph.D. Thesis, Memorial University of Newfoundland, Canada.
2. Zavadskas, E.K., Kaklauskas, A., Peldschus, F., Turskis, Z. (2007). *Multi-attribute assessment of road design solutions by using the COPRAS method*. The Baltic Journal of Road and Bridge Engineering. 2007, Vol. 2, Iss, 4, pp. 195–203. ISSN 1822-427X.
3. Zavadskas, E.K., Kaklauskas, A. (1996). *Determination of an efficient contractor by using the new method of multicriteria assessment*. In LANGFORD, D. A., RETIK, A. (eds.) International Symposium for “The Organisation and Management of Construction”. Shaping Theory and Practice. Vol. 2: Managing the Construction Project and Managing Risk. CIB W 65, London, Weinheim, New York, Tokyo, Melbourne, Madras. 1st ed. London: E and FN SPON, 1996, pp. 94–104. ISBN 0-419-22240-5.